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ART. I.—ON QUASSIA EXCELSA.

By J. Carson, M. D.

(*With a Plate.*)

The lofty Bitter-wood tree.

Quassia excelsa. Picræna excelsa—*Lindley.* Picrania amara—*Wright.* Simaruba excelsa—*De Candolle.* Quassia polygama—*Lindsay.*

Sex. Syst.—*Decandria monogynia.*

This plant has been made the basis of a new genus by Lindley, and of one by De Candolle, who has included another plant with it. Where generic characters which would place it with Quassia fail, it happens apparently, by abortion, and we have preferred to retain the old name of Swartz. The sexual arrangement is difficult. From the unisexual flowers of both kinds produced by abortion, intermingled with the hermaphrodite, it should be located in Polygamia, Monœcia. The use of this class, however, has been abandoned by most botanists, and we have specified in the appropriate place the class and order of the genus Quassia.

Gen. Char., as given by Lindley, is the following: *Flowers* polygamous. *Sepals* five, minute. *Petals* five, longer

than the sepals. *Stamens* five, about as long as the petals, rather shaggy; *anthers* roundish. *Ovaries* three, seated on a round, tumid receptacle. *Style* three-cornered, trifid; *stigmas* simple, spreading. *Fruit* three, globose, one-celled, two-valved drupes, which are distinct from each other, placed on a broad, hemispherical receptacle.—(*Flor. Med.*)

Spec. Char. A tree fifty to sixty feet high, with the branches spreading, the bark rimose, ash-coloured. *Leaves* alternate, impari-pinnate; leaflets opposite, shortly petioled, oblong acuminate, unequal at the base, blunt at the apex, venose, glabrous. *Racemes* towards the ends of the branchlets axillary, very compound, panicled, sub-corymbose, dichotomously branched, spreading, diffuse, many-flowered. *Peduncles* compressed, rufescent, downy. *Flowers* small, pale, polygamous. *Filaments* of the male flower much larger than the petals; in the fertile, of the same length. In the male merely the rudiments of the pistil; in the fertile, *ovaries*, three; *style*, longer than the stamens, three-quetrous, trifid. *Drupes* three, but only one coming to perfection, the size of a pea, black, shining, fixed on a hemispherical receptacle; *nut* solitary, globose, with the shell fragile. (*Macfadyen.*)

In Jamaica, where it is abundant, the plant is called *Bitter-ash* and *Bitter-wood*; it grows in the mountains of this island, and others appertaining to the West Indies.

In 1791, a paper, by Mr. John Lindsay, Surgeon in Westmoreland, Jamaica, was read before the Royal Society of Edinburg, (see Vol. iii. *Trans.*,) in which he called the tree *Quassia Polygama*. Sir Hans Sloan, who called at Barbadoes, noticed the *bitter wood*. In his Catalogue he described it thus: *Melanomma* et *Melanoxylon*, arbor lancifolia, *gemmis nigricantibus*, Americana. He refers to Plankenet, Tab. 205, p. 3, which plant (*Simaruba*) Lindsay says is different from his. Dr. Patrick Brown and Mr. Long mention the tree in their Histories of Jamaica, by the

name *Xylopicrum*, *Xylopia glabra*, *Bitter* wood and *Bitter* ash.

Dr. Wright, in his account of the medicinal plants of Jamaica, bestowed the name *Picrania amara*.

This wood is imported in billets, covered with the smooth grayish, sometimes silvery bark. It is white, light, and even in its texture, but becomes darker from exposure. The taste is intensely bitter. It contains the peculiar bitter principle, *Quassin*, as well as of volatile oil a minute trace, gummy extractive, pectin, woody fibre and salts, of which nitrate of potassa is most prominent.

Quassin was first isolated by Thomson, of Glasgow. It occurs in small, white, prismatic crystals, fusible, odourless, intensely bitter, readily soluble in alcohol, but slightly so in water or ether. Its solubility in water is increased by several salts and vegetable principles. Its watery solution is precipitated white by tannin, but not by iodine, chlorine, corrosive sublimate, salts of iron, acetate or diacetate of lead. It is a neutral body, though soluble in sulphuric and nitric acids. Its composition is C^{10} H^{6} O^{3}.—*Wrigger's Ann. der Pharm. and Pereira's Mat. Med.*

The medical effects are those of a pure bitter, tonic and roborant, and as such Quassia-wood is used in convalescence, dyspepsia, &c. The mode of exhibition is in cold infusion, made from the chips or raspings, in tincture or extract. In France it is a practice to have cups turned from the wood, and to allow water to stand in them until it becomes imbued with the active principle.

The wood is excellent timber, takes a polish, and is used in flooring; it is so obnoxious to insects, that furniture is sometimes made of it, as, for instance, bedsteads and clothes' presses.—*Macfadyen.*

Fee informs us that upon the bark of this tree he has found thirteen parasites, while upon that of the *Q. amara* he has found but one, and that not a lichen. The wood was confounded with that of the *Q. amara*, until the source

of it in large billets was pointed out by Lamark in France and Lindsay in England.

In France an insipid wood is said to be substituted for the genuine.

ART. II.—PHARMACEUTICAL OBSERVATIONS.

By R. H. Stabler, of Alexandria, Va.

Iodide of Potassium.

The difficulty experienced in my first efforts to prepare this salt pure, and free from colour, by the adopted formula of our Pharmacopœia, has led me to examine each of the processes by which it is prepared, in order to select one capable of furnishing a uniformly good article, easy of execution, and attended with as little loss of material as possible.

The pharmaceutist finds it difficult to execute the United States process, owing to the necessity of first forming an iodide of iron, which is to be exactly decomposed by the solution of carbonate of potassa; to do this requires much care, and even when accomplished he will find the product very apt to be coloured by a portion of adhering oxide of iron of which it cannot be wholly freed unless exposed to a dull red heat, dissolved, filtered, and re-crystallized, thus rendering it necessary to multiply the number of steps to the process.

The London and Edinburgh processes have several objectionable points, which are fully commented on in the United States Dispensatory and need not be mentioned further here.

The mode of preparing this salt which I would submit,

is modified from that mentioned by Pereira as having been proposed by the late Dr. Turner, and has yielded the best results in my hands; it is as follows:—

Saturate a hot, freshly prepared solution of potassa, with iodine added in small quantities at a time, and stirring well after each addition, until the liquid shows a slight excess of iodine, by the reddish colour imparted—evaporate the solution and mix the resulting salt with about an eighth of powdered charcoal, and subject it to a dull red heat in a common iron pot; the iodide is next dissolved out of the residue, the solution filtered, and on evaporation yields a perfectly pure salt.

The iodide prepared as above gave no trace of carbonate of potassa, chlorides, sulphates or iodates; the pure salt is deliquescent as it slowly liquifies when exposed to the air.

Liq. Ferri Iodidi.

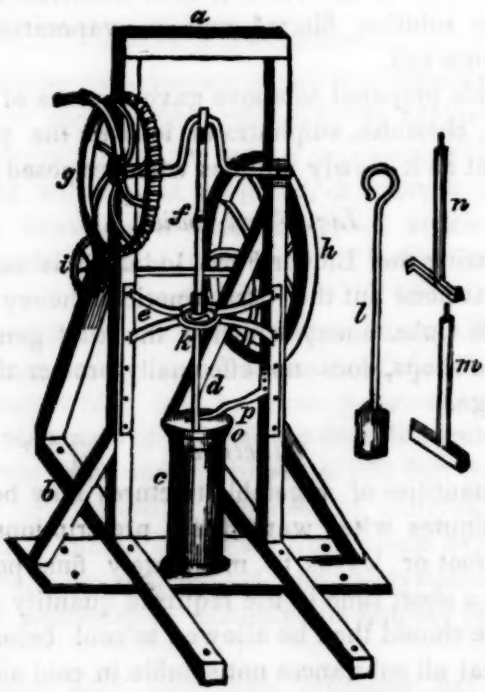
In preparing the Liquor Ferri Iodidi, it is important to observe that none but the best American honey should be used, as the Cuba honey which is the kind generally met with in the shops, does not effectually protect the solution from change.

Tinctures.

Small quantities of vegetable tinctures may be prepared in a few minutes when wanted for prescriptions, by reducing the root or leaves to moderately fine powder, and boiling for a short time in the requisite quantity of alcohol; the tincture should then be allowed to cool before filtering, in order that all substances not soluble in cold alcohol may be deposited. This process requires less time for its execution than that of displacement.

ART. III.—REPORT TO THE COLLEGE OF PHARMACY ON A MACHINE FOR MAKING MERCURIAL PILL MASS, INVENTED BY J. W. W. GORDON, of Baltimore. Read and adopted at the Pharmaceutical meeting held December 18th, 1848.

In order to make the report of the Committee intelligible, we have had prepared a wood cut representing the apparatus of Mr. Gordon, and append a short description of its parts.—[Editors.



a, *b*. Is a solid frame of wood about 5 feet in height.

c. A cast iron cylinder 7 inches in diameter and 16 inches deep, in which the materials are placed.

d. The piston and knife, in position.

e. The guiding plate and arms, with the plates on which it slides, attached to the frame work.

f. The connecting rod communicating the motion from the crank to the guide plate and piston.

g. The large cog-wheel attached to the crank 19 inches in diameter, with an arm to which the handle is fastened.

h. The fly-wheel—to regulate the motion of the machine, to which a handle is attached. This wheel is placed on the same axle with a small cog-wheel,

i. Which communicates with the large cog.

k. Is a revolving plate attached to the guide-plate, the circumference of which is armed with teeth. The brass cap of the connecting rod which connects it with the guiding plate, is furnished with projecting arms, which press alternately against two palls catching in the teeth of the revolving plate, which palls are kept in position by two semi-circular springs attached to the guide-plate on either side. The motion of the connecting rod back and forth occasioned by the revolving crank, causes the arms of the cap to press against the palls, and thus force around the revolving plate. The piston is screwed into this from beneath, and consequently revolves with it six revolutions of the crank, affecting one of the piston. (The engraving is defective at this point, and does not convey a correct idea.)

l. Is an iron spade curved to suit the cylinder, and used for removing the mass.

m. The two-bladed knife, the outer sides being bevelled; the inner flat; the blades being about 3-16ths of an inch thick at the centre.

n. Is the one-bladed piston. This blade is constructed like those just described, except that the ends of the knife are turned in opposite directions about 3-8ths of an inch.

o. Is a tinned iron funnel-shaped rim, which fits closely on the top of the cylinder, and is intended to prevent waste by the lifting effect of the knives at the beginning of the process.

p. Is a movable scraper attached to the wooden frame-work, and pressing slightly against the piston rod or knife-handle, and which is intended to keep it free from the mass.

When the full charge of ingredients, thirty pounds, is introduced into the cylinder, the handle is attached to one of the spokes of the fly-wheel, and the power then applied till the materials are mixed to a certain degree. The quantity is then reduced to one-fourth, and the power applied to the handle or the large cog-wheel. It is necessary that the machine be fastened firmly to the floor.

To the Philadelphia College of Pharmacy :

The Committee appointed to witness the operation of J. W. W. Gordon's apparatus for making blue mass, and to examine the product afforded by it, report as follows:

Having made an arrangement with Samuel F. Troth & Co., who kindly offered to facilitate the views of the Committee by accommodating the apparatus at their warehouse ; and the ingredients for thirty pounds of mass having been obtained of good quality, viz. ten pounds of mercury, fifteen pounds of conserve of hundred-leaved roses, and five pounds of powdered liquorice root ; the inventor commenced operations by placing the mercury in the cylinder, then throwing in all the conserve but two pounds ; on this the powdered liquorice was placed, and lastly the remaining conserve. The object of this last addition is to prevent the waste of the liquorice powder.

The two-bladed knife is then attached to the guide-plate. The scraper screwed in its place, and the machine put in motion ; the power being applied to the handle on the fly-wheel, which necessarily rendered the motion of the piston very slow. This action was continued for two hours, when the greater part of the metal was disseminated through the mass, though the globules were mostly visible. The contents of the cylinder were now removed, and then divided into four parts, that taken from the bottom having most mercury in it ; one-fourth of each of these quarters was placed in the cylinder, the handle attached to the larger cog-wheel, the single-bladed piston screwed in place, and the power applied. The piston moves with nearly five times the rapidity in this case, and was suffered to run twenty minutes, when the mass was removed and another charge introduced, composed in the same manner of each of the quarters, which was treated for twenty minutes as before ; the remaining portions were successively subjected to the action of the knife for the same length of time. When examined, the mass had changed in colour to a bluish cast, and the mercury was sufficiently divided to be hardly

visible to the eye. The whole was then kneaded as bread dough for a few minutes, and divided into four portions, each seven and a half pounds, one of which was put into the cylin der and operated on with the single knife piston for twenty-five minutes, when it was removed, and another charge introduced in the same manner. This was repeated on each of the other quarters for the same time. By this third treatment the mass had acquired the ordinary colour of blue mass, though not so dark as usual; the mercury was invisible to the unassisted eye, and but slightly with a common lens. The quarters were again sub-divided as before, and the machine kept in motion for half an hour on each fourth, the single knife being used. The mass now had the proper bluish-grey colour, was smooth and uniform in texture, and when examined with a lens, but slight traces of mercury globules were visible, not more than are frequently observable with a glass of the same power, in the commercial mass. The inventor was of opinion that the mass should be treated once more for half an hour on each quarter, which was accordingly done, when he pronounced the mass finished. Owing to the method adopted of operating on one-fourth at a time, the actual period during which the machine was in motion in finishing the whole 30 lbs. exceeded that prescribed by the inventor, amounting in all to nine hours, but if the delays occasioned by removing the mass be added, the time will be 3 hours more. But the actual time required to have finished any fourth of it would be 3 hours and 45 minutes. The reason for operating on a fraction was that the power of one man is insufficient to turn the crank axle, with the whole quantity in the cylinder, and if the power is applied to the other axle, the motion of the piston is too slow to affect the object within the time specified.

Analysis.—The products of the last four operations of the machine were each submitted to analysis by the plan of Dr.

Reid; 50 grs. of mass mixed with 10 grs. of iron filings, was put in a bulb blown on the end of a tube; the tube dipped into a wide-mouthed vial containing a portion of alcohol, and heat applied, until the bulb became red hot, and continued until all the mercury was driven over. The mercury, together with the empyreumatic oil, is condensed in the tube, and run down into alcohol, which dissolves the latter, the metal remaining intact. It is washed with alcohol several times, and then thrown on a weighed filter, and when dry its quantity ascertained. The result was as follows:

1st	quarter	yield	per	100 grs. =	32	grs. of mercury.
2d	"	"	"		32	" "
3d	"	"	"		32½	" "
4th	"	"	"		33	" "

From these essays it is certain not only that the mass contained the requisite amount of mercury in the aggregate, but it was uniformly disseminated throughout the whole mass—as the quantities yielded by the several analyses correspond as nearly as under the circumstances could be expected.

Action of the Machine.—As the surface producing the friction or mixing action is so small, the committee were very skeptical of the powers of the machine to effectually disintegrate the mercury and disseminate it through the mass; but the opportunity they have had of witnessing its action, has convinced them that it is perfectly competent to divide the mercury and mix it. The inventor is of opinion that the globules of mercury are bisected by the knife, and hence he believes that the machine acts more rapidly when the mass is stiffer, because then it offers greater resistance to the knife, and the globules are not pushed aside without being cut through. Whether this opinion is the correct one or not, it is certain that the stiffness of the mass has very much to do with the rapidity of the process. The knives act both up and down, as they are bevelled to a sharp edge either way on one side, and flat on the other, and this

bevelling is sufficient to produce a pushing and lifting effect on the mass; the knife never rises and falls in the same place, at any two consecutive movements, but is continually revolving about six revolutions of the crank, producing one in the knife. Every part of the contents of the cylinder is visited by its effects. The mass is not exposed to the action of the air in this machine to the same extent as it is in the triturating process, nor is there so great a surface for evaporation. It is believed that the colour of blue mass becomes darker by age, a change due possibly to an oxidizing action exerted on the surface of the minute globules. The colour appears to darken with the minuteness of the globules, or state of division of the mercury also, because every succeeding operation of the machine caused the colour to deepen; and the inventor says that by continuing its action for a length of time, the colour may be made considerably darker than the mass as finished under our observation. During the progress of the experiment as before stated, the committee took the precaution to set aside a sample of each quarter of the mass in each of the operations. In subsequently comparing these under a good lens, the gradual progress of the division of the mercury is very apparent, until in the finished article the globules are barely visible, and when compared with a mass of acknowledged good quality, made by the triturating process, the degree of division was equally great, if not greater, and fewer instances of separate larger globules, as are often found in mass.

The fibrous texture of the conserve is reduced to a uniform state by the cutting action of the knife which is very sensibly visible on comparing the earlier with the later samples of the mass.

In reviewing the operation, we are of opinion that the power of one man is not sufficient to turn the machine with its full charge, with that rapidity requisite to make the pill mass in six hours. We believe that it is much better adapt-

ed to the constant power derived from steam when the motion can be continued until the mass was finished, without the delay and trouble of removing it so frequently from the cylinder which also occasions loss, yet with a smaller charge, say ten pounds, they think the machine fully adequate in five hours to finish it when turned by hand, and consequently that it will prove extremely useful in the hands of those druggists who may desire to prepare their own mass. It would probably be to the advantage of the inventor to make a size smaller in which the cylinder will be of less height and the arm of the crank consequently shorter, proportioned to the shorter stroke of the piston, which would give the operator more power and make the removal of the mass less difficult. Another size might be made for the manufacturer capable of acting on a charge of 100 lbs., the force being derived from steam or other power; and as a few hours more or less is of little consequence in this case, there would probably be great advantage from using the machine 10 or 12 hours instead of six.

In conclusion the committee would observe that this apparatus is a very valuable addition to the pharmaceutical laboratory, as it places within the reach of every druggist a means of making blue pill mass of good quality within a reasonable time.

They therefore would recommend the apparatus to the favorable consideration of the College, and believe it worthy of the adoption of those members of the profession who wish to manufacture their own mercurial pill mass.

WILLIAM PROCTER, JR.
THOS. P. JAMES,
WM. J. JENKS,
AMBROSE SMITH,
EDWARD PARRISH,
JOHN H. ECKY,

Philadelphia, Dec. 18th, 1848. *Committee.*

ART. IV.—ON THE CULTIVATION OF OPIUM IN ARMENIA, Translated and condensed from the French of M. H. GAULTIER DE CLAUBRY. By EDWARD PARRISH.

IT has been found by repeated experiments that in some tropical countries, opium may be cultivated to great advantage, whilst in others, as the district of Aiden, where its cultivation is extensively practised, it is unprofitable, the juice of the poppy, when extracted, being so thin as to furnish a feeble product, or be lost by running down the plant upon the ground.

This difficulty is attributed, among cultivators, to various causes; by some to the dampness of their fields, by others to the exposure of their lands to the south, while some charge it to the excessive heat of the climate. Another source of difficulty is a deficiency of laborers in gathering the crop, from which it hap pens that some of the plants are too ripe and others not ripe enough at the time of extracting the juice.

In *Karra Hissar*, though the people possess considerable knowledge of this kind of culture, yet owing to a deficiency of water with which to irrigate the soil, the opium is black, and only one-twelfth the strength of the Armenian opium. The bombarders of Karra Hissar, in garrison at *Kalèi Sultanié*, use it, however, with advantage.

The poppy has been found growing wild at *Tékir Dagh* in a church yard near the sea; but although a little juice may be extracted by incision, it was found to be comparatively feeble and inert for want of cultivation. Although *Afion Karra Hissar* is the seat of the most successful production of opium, yet the desire and taste for its cultivation is extending rapidly over the surrounding country, and the zeal of the planters is crowned with success.

In *Emide*, which is a large town situated near *Tarchanle*,

excellent opium is produced, the price of which is high, and it is here that instructions in relation to its cultivation were obtained.

Influence of the soil.—Damp fields are not suited to the culture of opium by reason of the ice which is formed in winter mutilating the seed; it is also important that the ground should be dry at the time of the incision. The best soil is that which is always dry, *avide d'eau*, and which is so situated as to be readily watered, so that in the absence of rain it may be irrigated either during the ploughing, sowing, or afterwards. A hard and strong soil obstructs the free penetration of the root, and the plant and capsule are not fully developed, while a light gravelly or sandy soil, particularly that of a red colour, sufficiently manured, is best calculated for its successful cultivation.

Culture.—If the field is in a plain or on a mountain, and especially if the soil is already enriched by the manure of flocks of sheep, it is ploughed twice in the spring, and then left exposed to the rays of the summer sun, and to the rigours of the winter, until the following spring, when they plough it a third time, and sow the poppy seed. If the situation and character of the soil is favorable, and the weather fine, and if the cultivators are honest and experienced, an excellent variety of opium is obtained, which is called *Kez Afioni* (opium of the family.) The ground is not harrowed after sowing, as is the case with wheat and other grains, though some attach a bush to the plough by a cord, which is drawn after it so as to effect a light covering of the seed; the furrow is allowed to remain for shelter to the young and tender plants.

Varieties in the seed.—There are four species of poppy seeds found in Armenia, white, yellow, black, and blue. Of these each variety produces a different coloured flower, namely: that of the white seeds is lilly white; of the yellow red; of the black, black; and of the blue, a deep purple. The white and blue varieties of seed produce large capsules, a

little oblong in shape, the yellow and black produce small and perfectly round heads. The white seed are preferred by cultivators, being exceedingly oleaginous, and in demand for the manufacture of poppy oil. The yellow variety yields an abundance of the juice, and the black a heavy product. In some places the blue seeds are esteemed also.

The white and blue seed are sown near the house for the greater convenience of the peasant in cultivation.

Time of sowing.—Careful cultivators having assorted and selected the best seeds, sow them according to the following directions. The white and blue are sown on the plains, in a dry soil, about the end of September or beginning of October. The cultivator, however, failing a suitable occasion in the autumn, for want of rain, watches a favorable opportunity from the end of January till March, when if one occur, he sows the white and blue seed, or if not, he abstains.

The yellow and black seeds are sown in elevated and mountainous regions, and the most favorable time is about the beginning of April.

Before sowing, the seed are thoroughly mixed with ten times their weight of finely powdered and sifted earth; they are then scattered over the soil.

For a space of ground forty paces square, forty drachms of the seed suffice.

It is important that at the time of sowing, the ground should be neither too dry nor too moist. The most suitable state of the soil is that which occurs after the rains have ceased to inundate the fields and melt the ice; as the moisture then evaporates, the ground becoms soft and spongy.

Care and treatment of the plants.—When the plants have grown to the size of lettuce, the planters hoe around them with care, and on the appearance of weeds repeat the operation. If they grow too closely together, they pluck the most feeble, so as to leave between them a space of about a foot, (deux empans.) In about twenty days after-

wards, they hoe around them a third time. Though the weeds, when allowed to grow during the summer, suppress the growth of the plants and diminish the yield of juice from them, they are a protection during the rigours of the winter season. If the season is dry, the cultivators water the plants each time they hoe them, and if the soil is strong or heavy, they water them with great diligence till the time of flowering. When the plants have attained about three feet (one metre) in height, it is found necessary to prop some of them, as in some cases a number of stalks and as many as 35 capsules are produced from a single root.

Of the injuries besetting the plants.—Plants sown in the autumn are very liable to be injured by the frost; if, however, they are covered by snow, this difficulty is obviated. Those sown in the spring sometimes suffer from the same cause, especially when a white frost is followed by the hot sun; if rain supervenes, however, no injury is likely to result. After the plants have grown to the size of lettuce, they are not liable to injury from the frost. The young plants are also injured by exposure to the sun after a thick fog, the moist leaves being burned by the excessive heat. On this account it is desirable that the field should be situated at the foot of a mountain, so as to allow of the plant becoming dry after a fog or white frost, before being reached by the sun's rays. When the young plants are stunted or injured from these causes, careful cultivators plough the field again, and sow the seed a second time so as not to lose the entire season.

Manner of collecting the juice.—When the plants attain the height of 2 feet (*un archen*) the corolla expands; this is composed of four petals, which, after seven or eight days, dry up and fall, exposing the capsule, which is then about the size of a nutmeg, and goes on increasing from day to day. It is generally between the 20th of July and the middle of August that the plant has arrived at perfect maturity. The proper time for the extraction of the juice is deter-

mined by regarding the following indications. In the first place, it is observed that the leaves become yellow and the bright green of the capsules takes a reddish tinge; the operator then takes the precaution to incise a few of the capsules, and if the juice does not exude, or if it runs down the plant, or if the secretion is of a dark colour, he is assured that the proper time has not come:—But when he obtains a thick fluid, resembling milk in colour, he proceeds immediately to collect the crop, as the least delay after this time lessens the amount which may be gathered. Having taken these precautions, the operator enters the field at break of day, and turning himself toward the east, he incises the capsules to the end of the first side of the field, moving backward toward the other side, that the juice which exudes on incision may not be wiped off by his clothes. The part incised ought to remain exposed to the sun, therefore he continues in this position till noon, when he turns his face toward the west and continues the operation which is performed in the following manner. He introduces the index and middle finger of the left hand by the base of the corolla under the capsule, resting the thumb on the summit, and he incises across its breadth with his right hand, near the middle. The incision should be made carefully so as not to involve more than half the thickness of the capsule. If the incision is not deep enough, the juice does not flow; if too deep, it runs down within instead of exuding. If the incision is properly made, the juice appears soon afterwards, in tears, about the colour of milk or sometimes of a brown colour; the sun thickens it and imparts to it a red tint,

An instrument has been recently invented in Armenia for incision, resembling a lancet, with which a workman can operate with uniformity and precision with his eyes shut.

The next day the laborer resumes his operations upon the remainder of the capsules, and when the heat begins to be felt, if the atmosphere is without fog, proceeds to collect

the opium from those incised the day previous; this he does by drawing his knife over the line of the incision where the matter is collected; he thus collects on the knife the matter from one or from several heads, and deposits it on a leaf of the poppy; some use the leaf of the grape vine or other plant, although this practice is not generally approved. When he has collected a sufficiency, he wraps and compresses it in the leaf. The leaves that are used should be yellow, as the green leaf blackens the opium. It is also necessary to have the precaution not to use leaves which are so much dried as to break up when used. If the second day of the incision is foggy, the opium does not become dry, and is not collected till the following day, unless it should rain. Although the fog blackens the exudation, it does not injure its quality.

When gathered in very fine weather, the opium is in denticulated tears of a red colour. This is *Kez Afioni*, (the opium of the family,) produced only by four species of seed. The principal circumstance which contributes to the excellence of this opium, is the serenity of the weather, though a red soil and careful tillage contribute toward the production of a good article. The most favourable localities for opium are those which are the least foggy, by reason of constantly prevailing winds. Such are Emide and Giurez, and hence the fame of the opium of those countries.

Laborers who have not been accustomed to incising and collecting the juice, after being engaged at it some hours become intoxicated; cases of this kind are numerous and remarkable; it is observed also of infants at the breast, who are carried by their mothers to their work, that though placed at a distance from the field, and only occasionally visited and nursed by them, they often fall into a state of drowsiness, and sleep till night from the odour of the opium upon the clothes of the mother. These children sometimes grow up dull and stupid from the opium being too freely employed by their mothers when desirous of leaving them

alone for a long time, while at their work. In order to avoid this drowsiness while at their work, many labourers attach an onion cut in two in front of them, and carry another with them, which they smell occasionally. This is found to protect them from any such inconvenience.

From a single capsule they obtain a *grain* of matter; one *measure* of ground produces at most 3,750 *drachmes*, (Fr.) or 15 tchékis, 250 *drachmes* (Fr.) being estimated to our tchékis, though sometimes they are so unfortunate as to gather only one tchéki from that space.

After the extraction of the opium, the capsules are allowed to remain, in order to procure from them the seed. After a time they are cut off from the stalk and spread out upon the ground to dry; when a suitable occasion arrives, they are spread out and stamped upon till thoroughly broken up, the whole being then transferred to a large basin filled with water; the rinds float on the surface, and are thus separated from the seed, which are collected in the bottom of the vessel and preserved.

When the different species are mixed, and it is designed to separate them, it is necessary to puncture each capsule and ascertain the colour of the seed, and to divide them into separate portions before proceeding as above.

ART. V.—ON DRUG-GRINDING.

By Mr. Theophilus Redwood,
Professor of Chemistry and Pharmacy to the Pharmaceutical Society.

A large proportion of the solid substances employed in medicine, are submitted to certain processes by which they are reduced to powder, either as a preparatory step to subsequent pharmaceutical processes, or to fit them for administration in the solid state. It is, therefore, an interesting

and important question—whether, and to what extent, do the operations connected with the pulverization of drugs affect their composition, strength, and general medicinal efficacy?

Every druggist is familiar with the usual method of powdering drugs by the use of the pestle and mortar. This is the process usually adopted by the retail pharmaceutist. But the greater part of the drugs which are used in powder are reduced to that state previously to their passing from the wholesale dealers, and in these cases the process is generally conducted by persons who make it their special business, and who are called *drug-grinders*. The establishments at which drugs are thus reduced to powder, are called *drug-mills*, and the implements used there for effecting the disintegration of the drugs, are the *grinding-mill* and the *stamping-mill*.

The essential features of the means by which disintegration is effected at the drug-mills, are the same as those which characterize the more familiar processes of the druggist. In both cases comminution is effected by *contusion* and by *trituration*.

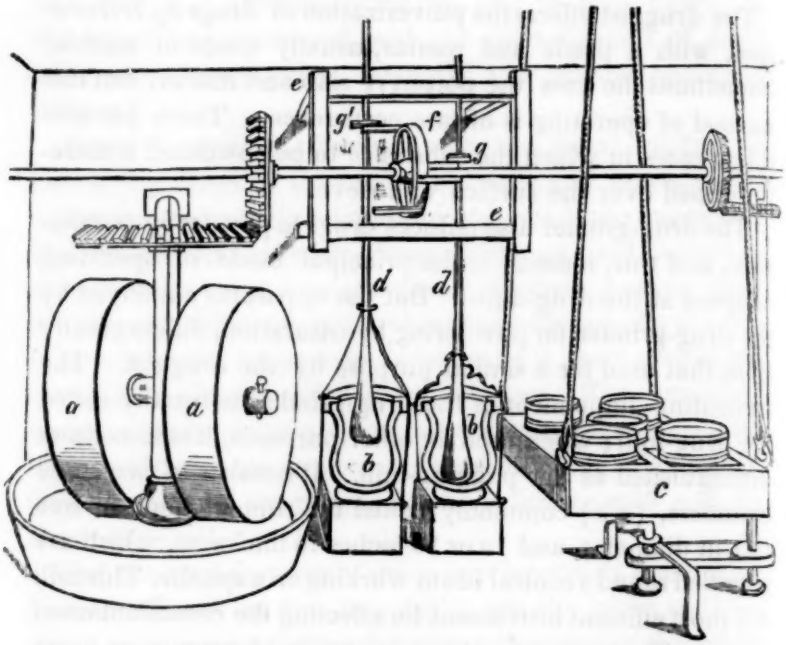
The druggist effects the pulverization of drugs *by contusion*, with a pestle and mortar made of some hard metal—either iron or bell-metal.

The drug-grinder also reduces drugs to powder, in some cases, *by contusion*, and his implements are the pestle and mortar, which differ but little from those used by the druggist. But the pestle and mortar of the drug-grinder is called a *stamping-mill* or stamper. The pestle, instead of being worked by manual labour, is raised by machinery, and allowed to fall with the impetus of its own weight, as shown at *d e f g* in the drawing at page 22. These pestles usually weigh from thirty to fifty or sixty pounds. These mortars, which, in common with the pestles or stampers are of iron, are not larger than those commonly used for powdering drugs with the spring pestle.

The druggist effects the pulverization of drugs *by trituration*, with a pestle and mortar, usually made of marble. Sometimes he uses the porphyry slab and muller, but this method of operating is of rare occurrence. There are also a few cases in which the substance to be powdered is merely rubbed over the surface of a sieve.

The drug-grinder also reduces drugs to powder *by trituration*, and this, indeed, is the principal mode of operating adopted at the drug-mills. But the apparatus employed by the drug-grinder for powdering by trituration, differs greatly from that used for a similar purpose by the druggist. The triturating implement of the drug-grinder, is usually called the drug-mill; when used for other purposes, it is sometimes distinguished as the pugging-mill. It consists of two stone cylinders, (*a a*) commonly called the runners, four or five feet in diameter, and 12 or 15 inches in thickness, which are trundled round a central beam working on a spindle. This mill is a most efficient instrument for effecting the comminution of drugs. The runners, which are made of granite or other hard stone, and usually weigh a ton or more, break down or tear asunder the hardest and toughest substances. The disintegration is effected partly by weight of the stone, and partly by the grinding or triturating action produced in consequence of the outer and inner edges of the revolving cylinder, which are both equal, being made to perform unequal circuits in the same time. Thus, if either of the cylinders were simply trundled without control, it would proceed in a straight line, but being made to describe a circle immediately around the central beam, the outer edge of the cylinder has to travel through a longer path than that assigned to the inner edge, so that every advance onwards, by which the weight or pressure is imposed upon a new surface, is accompanied by a lateral friction caused by the unequal progression of the two edges of the cylinder.

A drug-grinding room usually contains a pair of stones (*a a*), a set of five or six stampers such as *b b*, and a sifting apparatus (*c*).



APPARATUS FOR DRUG-GRINDING.

a a. The drug-mill.
b b. The stampers.
c e. The guiding-frame for stampers.
c. The sifting apparatus.

The sifting apparatus consists of a square wooden frame (*c*), in which there are five or six octagon-shaped holes for the reception of the sieves. This frame is suspended from the ceiling by four ropes or chains, and its peculiar motion is effected by a rotating crank working in a socket in the bottom of the frame. A very irregular and jerking motion is thus imparted to the frame, and from thence to the sieves, by the joint action of the revolving crank, and of the ropes by which the frame is suspended. The sieves employed in the process are the common drum sieves.

The first operation connected with the grinding of drugs consists of drying them. If they are in large masses, they are cut or broken into small pieces to facilitate the drying process, and also to prepare them for being put under the

stones when dry enough to be powdered. The drying is generally effected in a room heated to about 120°, by means of a stove or steam-pipe. The most common method of heating the drying-room appears to be by the use of a cockle, that is, a stove having an outer case or jacket, between which and the fire-case there is a space for the circulation of air. A great many different forms are given to the cockle, which is sometimes made of iron and sometimes of brick; but it should always be so placed that the fire can be fed from the outside of the room, so that the atmosphere of the room may not be contaminated with smoke or dust. The substances to be dried are spread out on trays, which are placed on open frames around the room.

The drying process being completed, the substance is placed on the platform of the mill, in the path of the stone runners, where it is ground until sufficiently comminuted for the commencement of the next operation, namely, that of sifting it. The two operations of grinding and sifting are then continued simultaneously, the operator transferring a portion of the powder from the mill to one of the drum sieves, which latter, with its contents, is put into its appropriate receptacle in the frame of the sifting apparatus, where it is subjected to the requisite succussion. The residue, which does not pass through the sieve, is returned to the mill, and a fresh portion of powder taken out to be sifted; and this mode of proceeding is continued without suspending the motion of any part of the machinery, until the process is nearly finished.

In using the stampers, it is necessary to suspend the pounding or stamping while the substance under operation is being removed from, and introduced into, the mortar, which somewhat retards the process.

The facility with which drugs are reduced to powder depends in great measure upon the extent to which they have been previously dried. If they be not deprived of their hygrometric water to the greatest extent practicable by ex-

posure in the drying-room, it will be difficult, if not impossible, to produce perfectly smooth and impalpable powders, such as are now generally used in medicine. This drying is, of course, accompanied by a diminution of weight, arising from the loss of water and other volatile constituents, which varies considerably in different drugs, and also in different specimens of the same kind of drug. There is always, however, a little moisture again absorbed during the process of grinding.

There are some drugs which, however carefully they may be dried, are, nevertheless, with great difficulty reduced to powder by the ordinary method of proceeding. Nux vomica, St. Ignatius's beans, and the tuberous root of the orchis, belong to this class. They are tough and horny, and can hardly be powdered without a particular treatment. The best method of preparing nux vomica and St. Ignatius's beans for pulverization is to expose the seeds to the action of steam until they have swelled to about twice their original size, and then to dry them rapidly in the drying room. The roots of the orchis, which are ground to make saloop-powder, should be macerated in cold water until they have become soft, and then dried, as in the other case. After being thus treated they are easily powdered.

Some substances cannot be powdered alone; they require the addition of other bodies which facilitate the disintegration. Thus the addition of a few drops of spirit renders the pulverization of camphor easy, although it could not be effected without it. Agaric is a substance which it is extremely difficult to powder alone, and a method has therefore been proposed for powdering it *by mediation*. It is cut into small pieces, wetted with mucilage of tragacanth, and then dried, previously to submitting it to the process of grinding. The addition of a foreign body, which the powder retains, cannot, however, be sanctioned, excepting under particular circumstances, such as the impossibility of otherwise effecting the object. It is stated in some phar-

maceutical works that colocynth is powdered by mediation, in the same way as that above described for the pulverization of agaric; but in this case the addition of a foreign body is certainly unnecessary, and I am informed that no such addition is made by the drug-grinders in this country.

The foregoing is a general outline of the various methods adopted in effecting the pulverization of drugs. We may now return to the question,—how far do these processes affect the composition, strength, and general medicinal efficacy of the substances operated upon?

The operations connected with the process of drug-grinding do not seem to be calculated to promote chemical change in the constituents of the powder; for, although the disintegration, by exposing a larger surface to the action of the air, may be somewhat unfavourable to the permanence of the proximate constituents of vegetable substances, yet the complete desiccation which forms part of the process will exercise a conservative influence to probably an equal extent. This, at least, would be the case if the powder, when prepared, be put in close bottles, and kept for only a moderate length of time.

The principal, if not the only necessary, cause of deterioration to the products, is the long-continued application of the degree of heat to which the drugs are exposed in the drying-room. There are some substances which cannot be thus dried without having a portion of their active volatile ingredients driven off, as well as the water they contained. The strong smell which fills the drying-room when opium, or myrrh, or cinnamon, are under operation, affords sufficient evidence that some volatile matter besides water is escaping, and that the resulting powders cannot strictly represent the drugs from which they are made. All substances which contain volatile principles must lose a portion of these during the drying process which precedes, and sometimes accompanies that of pulverization; and if the efficacy of the medi-

cine depend upon these volatile parts, the product must be injured by the process to which it is submitted. Thus myrrh, valerian, cardamoms, cinnamon, and spices generally, lose some of their efficacy in being reduced to fine powder.

But a large proportion of our drugs are not subject to deterioration from loss of volatile constituents; and in these cases, if care be exercised in conducting the process of drying, the powder obtained by the usual method of operating will possess all the medicinal properties of the crude materials. Rhubarb, jalap, ipecacuanha, colocynth, scammony, gamboge, and many other drugs, are not necessarily injured in the process of powdering.

There are some drugs which not only suffer no injury in being powdered, but which actually contain, when pulverized, a larger proportion of the active constituents than were present in the crude unpowdered substance. This arises from the circumstance that the less active parts are separated and rejected during the process. Thus, for instance, the powder of ipecacuanha, if properly prepared, contains more of the emetic principle than the root from which it is made. The principle upon which the emetic property of ipecacuanha depends, exists chiefly on the cortical part of the root, and as this is the most easily pulverizable, it passes first through the sieve, while the less active ligneous part, being more tough, remains to the last, and should be rejected as gruffs.

Besides the loss of water and other volatile constituents, which are driven off in the drying-room, there is also necessarily a dissipation and loss to certain extent of solid particles of powder, which are diffused through the atmosphere of the room in which the pulverization is conducted, or which adhere to the apparatus.

With these exceptions the product, including the gruffs or unsifted part, ought to be identical with the substance it represents; that is to say, should consist of the same particles, and no others, in the same chemical condition as they existed in previously to the process of powdering.

If no active constituents be lost in the drying process, the strength of the powder will be greater than that of the crude drug, to the extent of the quantity of water and inactive matter which have been separated and rejected. It would be very desirable to ascertain what the average increase of strength is in those drugs which suffer no deterioration in the process of powdering; and also what is the exact nature of the deterioration necessarily sustained by drugs, such as myrrh, ginger, cardamoms, and cascarilla, which contain, and must therefore lose active volatile constituents.

Next to the preservation of the medicinal efficacy of the drug, the most important object for attainment is uniformity of strength in the product. What security has the physician that a grain of opium or ten grains of jalap obtained from a particular source shall be equivalent to the same quantities of those substances obtained elsewhere.

There are several causes which tend to affect the uniformity of the strength of those medicines which consist of parts or crude products of plants. In the first place, these drugs, in their natural or original state are not uniform in composition and properties. Different specimens of cinchona bark yield very different proportions of the alkaloid upon which the efficacy of the drug depends—other drugs differ to an equal extent; in fact, what drug can be mentioned of which there are not good and bad specimens, in their natural state, to be met with in the market? The practical knowledge and experience of the druggist are called into requisition in selecting the good from the bad, and thus two classes, at least, are formed. There may be some approach to uniformity in each of these classes, but what uniformity is there between them? It must be admitted, however, that the criteria of excellence usually adopted in these cases are often founded upon qualities of an extrinsic character, which have no definite relation to medicinal properties.

Passing, then, from this source of disparity in quality and strength, and having selected the best specimens of the

crude drugs, what further causes are there which may affect the uniformity of their properties when in more advanced states of preparation?

Much has often been said on the subject of the adulteration of drugs, and especially of those drugs which are used in the state of powder. That drugs are sometimes adulterated is a notorious fact. That the practice of adulteration has prevailed to an extent greatly prejudicial to the advancement of the science of medicine, and discreditable to the medical legislation of the country, admits not of a doubt. But a great and progressive improvement has certainly taken place for many years past, and there is, at the present time, an evident desire among wholesale and retail druggists, to discourage and suppress the sale of bad and adulterated drugs.

We may pass over the statements, some of them greatly exaggerated, which have been published with reference to the wholesale substitution of fabricated powders for the drugs represented. Such statements relate to by-gone days, and they probably represent what were, even then, uncommon exceptions to the practice generally pursued. There is reason to believe, however, that absolute identity of composition between the powders used in medicine and the drugs they represent, is not always maintained to the greatest practicable extent, even in the present day. The art of drug-grinding has undergone considerable improvement within the last twenty or thirty years. Many of the powders now prepared are very different in appearance from those which formerly were used; and much more attention is now paid to colour and other external characters. But, is it not to be feared that the high estimation in which *good looking* powders are held, may cause the adoption of certain methods of dressing them, and artificially improving their appearance? There is reason to believe that a small quantity of turmeric or other colouring matter, is sometimes used for the purpose of brightening and improving the co-

lours of some powders, and that oil is also added in some cases, during the process of comminution, with a similar object. These additions are made in such small quantities, that they probably would not occasion any appreciable difference in the action of the medicines, but the fact that any such means are adopted establishes the necessity for some better criteria of quality than the mere appearances.

There is yet another source of disparity in the quality and strength of powdered drugs, which consists in a conventional practice of the trade with reference to the allowance made for loss of product during the process of grinding.

It has already been stated that the loss of weight which drugs undergo in grinding, is occasioned by the evaporation of water and other volatile constituents in the drying-room, and by the waste from dissipation in the form of dust, and from adhesion to the apparatus, in the grinding-room. It must be obvious that the amount of loss thus sustained will not be uniform; it will vary according to the nature of the substance under operation, and even with substances of the same nature, the loss will depend upon the quantity operated upon at a time, and their state of dryness when sent to the mill. Some drugs are frequently met with in commerce in a perfectly moist state, such as opium, aloes, scammony, and jalap. The loss of weight in drying these drugs, must of course be considerably greater than that which occurs with other less moist specimens, or with substances, such as rhubarb, ipecacuanha, or bark, which are never met with in a moist state. Now, there is in this variable condition of drugs as to dryness, a source from which disagreement might arise between the druggist and the drug-grinder, which probably led to the adoption of a practice in the trade of making a uniform allowance for loss of weight in grinding, whatever the nature or quality of the drug might be.

The rule adopted among the London drug-grinders, has been to have allowed to them four pounds on every hundred-

weight of the substance ground, for loss in the process. Thus, if a hundredweight of rhubarb were sent to the drug-mills, 108lbs. of powder including the gruffs, would be returned. It matters not what condition the rhubarb might be in, the drug-grinder would be expected to produce 108lbs. of powder from 112lbs. of raw material. The same allowance would also be made, unless otherwise agreed between the parties, for all other drugs which required drying previously to their being powdered. In some cases the practice appears to have been to receive 116lbs. of the undried drug, and to return 112lbs. of dry powder. This is called the four per cent. system, four pounds being the allowance for loss upon every hundredweight of substance powdered. Some substances, however, such as cream of tartar and sulphuret of antimony, do not require to be dried before being powdered, and the allowance for loss on these substances is only two per cent.

This, which is commonly called the per centage, or four per cent. system, was at one time generally, if not uniformly, adopted by the drug-grinders of London, and although it has to a great extent been relinquished, having been wholly departed from by some houses, and partially by others, yet there are those who still contend that the specified allowance is a fair average of the loss necessarily occurring in the process of drug-grinding.

Being convinced of the injurious tendency of the four per cent. system, I applied to several parties engaged in the business of drug-grinding for information on the subject, and am indebted to one of these parties for a statement extracted from their books, showing the loss sustained in powdering drugs at their mills. Every drug powdered at the establishment alluded to, is weighed when received at the mill, and the ground products, consisting of fine powder and gruffs, are again weighed before being returned to the druggist. These weights are all entered in their books, a separate account being kept for each kind of drug, so that by taking an average of the results upon large quantities,

consisting of a great number of specimens received from different druggists, a near approach to a correct estimate is no doubt attained. The results nearly coincide with those observed by other drug-grinders from whom I have received information.

Name of Drug.	Total weight.	Greatest loss per cwt (112 lbs.)		Smallest loss per cwt (112 lbs.)		Average loss per cwt (112 lbs.)	
	lbs.	lbs.	oz.	lbs.	oz.	lbs.	oz.
Aloes, Barbadoes	379	9	12	0	7	5	12
" Hepatic	997	16	8	3	8	9	6
" Socotrine	882	12	0	4	0	9	4
Columba Root	733	12	0	1	12	6	6
Canella, alba	460	12	0	1	0	9	0
Cantharides	1006	3	0	—		1	8
Cardamoms	348	9	8	2	10	5	12
Cascarilla bark	794	8	14	2	0	6	0
Cinchona bark, pale	1547	7	8	4	0	6	6
" " yellow	1039	11	0	2	8	6	2
Colocynth	1034	11	8	3	8	6	8
Cubebs	1551	2	10	—		1	10
Dragon's blood	1004	13	0	1	4	5	12
Elecampane	1585	16	0	2	12	9	3
Fœnugreek	2593	13	0	2	0	7	10
Gamboge	1009	6	8	1	0	2	12
Gentian Root	5368	16	0	4	0	9	4
Ginger, Jamaica	8046	12	8	6	0	7	10
Gum Arabic	11,215	12	0	4	0	8	0
Ipecacuanha	2579	7	0	1	4	5	3
Jalap	9446	15	8	5	0	8	12
Liquorice	1255	12	0	—		6	3
Myrrh	2762	16	0	3	12	8	6
Opium	505	18	0	6	0	14	14
Orris root	3625	10	12	4	3	6	12
Rhatany	81	8	0	2	10	6	0
Rhubarb, English	1346	12	0	3	0	7	13
" Indian	5777	7	0	2	0	6	0
" Turkey	2018	8	4	3	0	5	12
Sarsaparilla, Jamaica	689	14	0	1	12	10	1
Scammony	1161	13	0	2	8	7	4
Seeds, Anise	2839	16	0	1	0	5	6
" Caraway	1569	13	8	2	8	8	12
" Coriander	1063	16	14	1	4	5	9
" Cummin	1142	12	0	1	4	5	4
Senna	606	11	8	3	8	6	6
Squill	974	15	0	8	0	12	8
Tormentilla root	231	12	8	2	0	6	12
Tragacanth	2077	13	12	6	12	8	4
Turmeric	5663	8	0	1	8	4	0
White Hellebore	5533	10	12	2	2	6	4
Valerian root	279	16	8	4	0	8	8

The first column of figures in the table represents the whole quantity of the specified drug which has been ground at several different periods; the second column indicates the greatest amount of loss on any one specimen; the third column indicates the smallest amount of loss on any one specimen, and the last column gives the average upon the whole.

It appears from this table that the average loss in powdering drugs is more than four per cent. in nearly all cases, and that in some it is considerably more. Now, it could not be reasonably supposed that the drug-grinder would in any case supply good rhubarb or jalap, gentian or ginger, for the water which had been imbibed in a damp warehouse or cellar. If he be required to make up a certain quantity of powder, evidently more than the crude drug produces, how is he to do it? Is he to keep a stock from which to supply the deficiencies of all the drugs he grinds, and go to market and purchase more when his stock is exhausted, or is there magical power in his mill?

A drug-grinder's mill is a very different thing from the pestle and mortar of the druggist, although they are both employed for the same purpose. The druggist, when he has used the pestle and mortar, cleans them preparatory for the next operation, by washing them with water. The drug-grinder also requires to clean his mill. Rhubarb must not be ground after aloes, nor ginger after jalap, without previously well cleaning the ponderous stones and other parts of the apparatus. But how shall this be done? A drug-mill cannot be cleaned by washing it with water—if for no other reason, it would be objectionable on account of its making the room and apparatus damp, which are required to be perfectly dry. Instead of water, sawdust is used for cleaning the drug mill. After grinding any drug, in order to remove the adhering particles from the mill, sawdust is ground until the mill is rendered sweet and clean.

Sawdust, then, is indispensable at a drug-mill, as necessary as water is in a druggist's shop, and if the druggist

sends damp jalap, containing fifteen per cent. of water, to be ground, and requires dry powder to be returned, with only four per cent. of deduction for loss, he adopts a conventional method of asking for some of the rinsing of the mill—a veritable "powder of post."

The four per cent. system cannot fail, wherever it is adopted, to induce a reduction in the strength of powdered drugs. If this reduction had tended to equalize the strength of different specimens, there might have been some excuse for it; but the effect of the system must obviously be to cause a reduction in an inverse ratio to the previous strength of the drugs, so that the weakest and worst drugs will be most diluted. But this objection which applies to the very principle of the system, is not the most serious objection to which it is subject. It sanctions the practice of admixture, and affords facilities for those who are disposed to pursue a ruinous competition in price at the sacrifice of quality.

There are two causes which, I believe, principally tend to frustrate the efforts of those who are endeavoring to put a stop to the adulteration of drugs, and to provide for the supply of medicines of the best quality; one is, the sale of cheap medicines by grocers and others not educated as Pharmaceutists, who are unable to distinguish the good from the bad, or indifferent as to which they sell; and the other is, the continuance, to whatever extent it may still prevail, of the four per cent. system in connexion with drug-grinding—a system which has no claim for support, save the old established usage of the trade. It should be the enlightened policy of an educated body of Pharmaceutists to afford a fair remuneration for honest industry; and this being secured, both druggist and drug-grinder would rejoice to be relieved from the trammels which have been heedlessly and most injuriously ingrafted upon the system of drug-grinding.—*Pharm. Journ.*

ART. VI.—ON AQUA-REGIA.

By M. Gay-Lussac.

Since the time of Berthollet, most chemists have considered aqua-regia, or the mixture of nitric and hydrochloric acids in variable proportions, as composed of free chlorine and nitrous gas, held in solution by the two acids, and more particularly by the nitric acid. Berthollet also showed that chlorine and nitrous gas combine at the moment of mixture, and are subject to a considerable condensation of volume. After 50 years of silence upon this point, Edmond Davy discovered that when nitric is allowed to act upon common salt, a gaseous mixture is evolved of an orange-yellow colour, which contains chlorine, and another gas easily absorbable by water. He likewise pointed out the similarity of this gaseous mixture to the condensible compound of chlorine and nitrous gas of Berthollet, and was led by his experiments to the conclusion that the gas was composed of equal volumes of chlorine and nitrous gas, united without condensation. Baudrimont here took up the investigation, and condensed into a reddish-brown liquid, by means of a freezing mixture, the gas evolved from aqua-regia. His analysis of the compound induced him to assign it the formula—

$$NO_3\,Cl_2.$$

and to substitute the name of chloronitric acid in the place of chloronitrous acid, given to it by Davy. This compound was considered by Baudrimont as the active principle of aqua-regia. Notwithstanding these experiments, the majority were still in the habit of viewing aqua-regia, with Berzelius, in the same light as it was viewed by Berthollet. The composition of M. Baudrimont's compound, and the

theory of its formation from the elements of aqua-regia, gave no explanation of the simultaneous production of chlorine, which was invariably observed by all who have studied this acid mixture.

M. Gay-Lussac has collected the gases evolved from aqua-regia at the temperature of boiling water; and, passing them through a cooling mixture, has succeeded in condensing a cloudy lemon-coloured liquid, very different in appearance from a mixture of nitrous vapour and chlorine, while chlorine gas passed off.

This liquid was completely decomposed by water, without the evolution of any gas, and the solution contained hydrochloric acid, but no free chlorine. The amount of chlorine in the original gas was ascertained by precipitating the aqueous solution with nitrate of silver, and the relation which it bore to the other compound of nitrogen and oxygen was that of 2 equivs. to 1 equiv.

An analysis of the gas by means of mercury, which absorbed the chlorine, led to the same result, and confirmed the identity of the nitrogen compound with nitric oxide. The composition of the liquid is, therefore, expressed by the formula—

$$NO_2 Cl_2$$

and this perfectly explains the simultaneous evolution of chlorine; 3 equivs. of oxygen, separating from an equivalent of nitric acid, give rise to 3 equivs. of chlorine, 2 of which remain in combination with the nitric oxide, and produce the new liquid acid, or *hypochloronitric acid*, while the other is liberated.

Aqua-regia, however, prepared under different circumstances, affords liquid products, which are by no means of such constant composition. When the muriatic acid of the mixture is replaced by common salt only just covered with the ordinary nitric acid of commerce, 2 equivalents of chlorine to 1.30 equivs., and another case to 1.53 equivs. of nitric oxide were obtained from the vapour of the liquid.

When gold is acted upon by aqua-regia, the nitric oxide in the mixture is reduced to somewhat less than 1 equivalent. These facts, and the different relative proportions of the two gases obtained from successive portions of the liquid, show that the body is a mixture, and that $NO_2 Cl_2$ is not the only constituent of the chloronitric liquid. There is at least one liquid in the condensed products from aqua-regia possessing the composition shown by the formula—

$$NO_2 Cl,$$

which latter may also be obtained directly by allowing nitric oxide and chlorine to condense together in a vessel surrounded by a cooling-mixture; but even then the product is not a definite body, for the proportions of nitric oxide gas in the less volatile portions are very much greater than in the more volatile. The same results were obtained from the vapour of the liquid condensed from a mixture of common salt with nitric acid.

These condensed liquids, prepared in different manners, are, therefore, mixtures in variable proportions of the two compounds, $NO_2 Cl_2$, and $NO_2 Cl$.

The products bear a great analogy to the hyponitric and nitrous acids, and it is proposed to call them *hypochloronitric acid* and *chloronitrous acid* respectively. They are both decomposed immediately by water, and give rise to hydrochloric acid and the products of hyponitric acid.

Aqua-regia, therefore, whether concentrated or diluted, without the agency of any other body, and simply under the influence of heat, is decomposed into chloronitric vapour, chlorine and water.

When gold is acted upon by aqua-regia, the author's experiments tend to show that the products of decomposition are precisely the same, the chlorine only being retained by the gold, and the chloronitric vapour, to which the action of aqua-regia upon gold has been erroneously attributed, passing off as if no gold were concerned in the reaction.—*Quarterly Journal of the Chemical Society.*

ART. VII.—ON THE CULTIVATION OF SAFFRON IN FRANCE AND AUSTRIA.

1. SAFFRON was not cultivated in France before the Crusades. The bulbs (*cormi*) from Avignon were introduced towards the latter end of the fourteenth century, by a gentleman of the family of Porchaires, who first planted them on his estate at Boyner. The botanical characters of the *Crocus sativus autumnalis* are well known. The same bulb, or cormus, flowers once only; and as soon as the flower is withered, a bud (*caïeu*) appears, which, after having produced several flowers in the autumn of the second year, also dies. After the third year the bulbs should be transplanted.

A dark, somewhat loose, sandy soil, in a sunny situation, suits it best. Heavy, wet, clayey, and freshly-manured soils are unfavourable for its cultivation. The usual manure is the marc of the grape. The bulbs are planted at the beginning of July, about twelve to a square foot. A temperature of 14° Fahr. is very injurious to them, in case the snow does not lie very high. In the Gatanais, the saffron herb dries up in May, but it is collected for feeding cows.

The saffron bulbs are subject to two diseases; one called the *tracon*, is a kind of dry rot (*carie sèche*,) the other termed the *death* (*la mort*) is chiefly humidity of the glandular bodies. Some agriculturists have cured the *tracon* by placing the bulbs for some days in well dried marc of grapes. The death (*la mort*) is incurable and infectious. Two different kinds of insects are found on the bulbs affected by this malady.

When the flowers are gathered, the stigmata (*le jaune*) are plucked off, dried and preserved in dry wooden boxes, for when well protected from dampness, the saffron keeps for years.

Saffron is adulterated by mixing it with safflower, marigolds reddened by salt, and shreds of beef (*la rouelle de bœuf.*)

Saffron is employed in dyeing, in cookery, in pharmacy, and in medicine.

In France and Spain, a balsam or saffron ointment is prepared from it, under the name of *Croco-magna* or *Crocium.* It is also used as a prophylactic against sea-sickness.

2. The saffron of Lower Austria is the best and most costly in Europe, but the produce is scarcely sufficient for the home consumption, and therefore saffron is imported. It is chiefly produced at Ravelsbach, Meissau, Eggendorf, Kirchbeg, and Wagram. Most of the saffron gardens have a substratum of loam, covered about a foot high with mould. Wheat fields are best adapted to the cultivation of saffron, the produce being three-fold that of the wheat. The gardens should be placed dry, exposed to the sun, and towards the south, and protected against northerly winds. They should not be shaded by forest trees, nor be too much elevated and exposed to the wind. Districts favourable for the cultivation of the vine suit best.

The flowering season begins during the last week of September, and ends in the first week of October; but it sometimes lasts till the beginning of November.

The soil is prepared after three methods; the first is similar to that of preparing a garden-bed.

By the second method, the field is ploughed in autumn after the harvest, the same as for wheat, only somewhat deeper and narrower.

According to the third method, the field is ploughed immediately after the harvest (whether of wheat, rye, or oats) and then rolled and harrowed. Three days before planting the field is trimmed. The manure is only added during planting, but so that it is well covered with earth and does not come in contact with the bulbs. This method requires

the best soil and the smallest and best manure, as sheep manure.

The saffron bulb is called in Austria *Kiel.* It is of the size of a walnut, surrounded by ten or twelve soft, brass like membranes, of a cinnamon-brown colour, which terminate at the top, around the germ, in capillary threads—called *Bollen*—but in such a manner that only about three of them reach the top, the others being shorter and finer. The multiplication of the saffron proceeds from these bulbs (*Kiele.*) No case is known of a flower producing seed. Each bulb produces within half a year, namely, between autumn and the end of spring, from one or two, or from three to four new young bulbs; but the parent bulb perishes in the meanwhile every year, and nothing remains of it but some coarse blackish brown membranes, called *Bollen*, and a dried hard mass—the *Plattel,* on which the young bulbs are seated. Before the bulbs are planted, they must be cleared of all membranes remaining of the parent bulb, of the plattel, &c., and all damaged or diseased bulbs rejected. They are stowed away three to four inches high, in a dry airy place.

The sowing is performed by two men, one making with a hoe furrows of eight inches depth, the other placing the bulbs three inches apart, and pressing them in the ground so that they are half covered.

The saffron flowers appear before the leaves, and can easily be removed, without disturbing the bulb. The best time for gathering them is early in the morning, while they are closed. When gathered, they are spread in a cool room, on cloth or straw mats, until fit for picking. The picking (called *Saffronlösen*) consists in separating the trifid stigma from the style, and removing it from the flower. This is done the day after the gathering, and must be performed without separating the parts of the trifid stigma (called the *Zunglein,* or little tongue) from one another. They should remain adherent, or, as it is said, "the *Bock*

should be entire." Little or nothing of the yellow style should be left attached to the stigma. In this way the saffron has a better appearance and fetches a higher price. On the following day it is dried on a hair seive over a charcoal fire; and placed in boxes without compression. After a few hours it becomes oily and flexible, and can then be pressed into well-closed boxes.

Most of the Austrian saffron is sold at Krems on the 28th of October. Its price is from 30 to 32 fl. [=36—38 fl. 24 kr. Rhenish] per pound.

After the crop of the first year, the green leaves are left growing till the spring of the next year, and in June, when they begin to wither and to become yellow at the top, they are mowed as food for cattle. The little bulb (*Knöllchen*) which in the first year had formed itself on the parent bulb, and from which a little tube, with or without flower, had already grown, in the autumn of the second year, goes on swelling till the spring. About Whitsuntide, the new bulb (*Kiel*) called *Kindel*, is perfect. If every thing goes on well, the saffron-garden will, in the autumn of the second year, contain two or three times the quantity of bulbs (each bearing two or three flowers) originally planted. If the bulbs are left for a third crop, nothing else is to be done but what was required after the first, namely, mowing the grass and carefully removing the weeds in July. It is, however, remarkable, that neither bulbs nor flowers multiply in the third year.

The bulbs having now yielded saffron for two, three, or four years, are removed about Whitsuntide, when the new bulb (*Kiel*) is fully developed, the saffron-grass gathered, and the old bulb quite disappeared. By means of a coarse seive they are cleaned of the adhering mould, and stored up in an airy barn or loft.

Three diseases are known to attack the bulbs. The first is the rot (*Faulniss*,) which, though visible externally, de-

stroys the substance of the bulb. The second disease is a turnip-like excrescence (*Rhizoctonia crocorum*, Decand.) which appears mostly on the inferior part of the bulb, which it deprives of its nourishment. Both this, as well as the beforementioned disease, is not common. The latter can be removed by picking the bulbs.

The third is the most fatal malady. It is called the *death* (*Tod.*) It consists in the formation of a malignant, woolly, truffle-like fungus, composed of several separate balls of the size of a hazel-nut. These are partly close to the bulb, partly one to three inches distant from it; but they never appear at the surface of the ground. From these balls, a large number of violet-coloured, fine, woolly fibres spread, partly from one ball to the other, partly surrounding the membrane of the bulb like a net. They penetrate between the membranes to the substance of the bulb, and then kill it. In Lower Austria the disease is called the *Brand, or Austand.* One such diseased bulb is sufficient to infect a whole garden. The existence of the disease is known by bare circular spots in the saffron-garden; in the bulb itself black holes are perceived, as if dusted with soot; sometimes they look as if burnt. Duhamel advises the spread of the disease to be checked by digging one foot deep around each infected spot, and placing in heaps the earth of the infected spots. —*Pharm. Journ.*

ART. VIII.—PREPARATION OF COLLODION, OR SOLUTION OF GUN-COTTON, AS AN ADHESIVE MATERIAL FOR SURGICAL PURPOSES.

M. MALGAIGNE has recently communicated to the French Medical Journals some remarks on the preparation of gun-cotton for surgical purposes. Several French chemists, at the suggestion of M. Malgaigne, attempted to make an ethereal solution of this compound by pursuing the process recommended by Mr. Maynard in the "American Journal of Medical Sciences," but they failed in procuring the cotton in a state in which it could be dissolved by ether. It appears that these experiments had employed a mixture of nitric and sulphuric acids; but Mr. Mialhe ascertained, after many trials, that the collodion, in a state fitted for solution, was much more easily procured by using a mixture of nitrate of potash and sulphuric acid.

For the information of our readers who may be disposed to try this new adhesive material, we here give a description of M. Mialhe's process for its preparation. It appears, from the results obtained by this chemist, that cotton, in its most explosive form, is not the best fitted for making the ethereal solution :—

Finely powdered nitrate of potash . .	40	parts	by weight.
Concentrated sulphuric acid *	60	"	"
Carded cotton	2	"	"

Mix the nitre with the sulphuric acid in a porcelain vessel, then add the cotton, and agitate the mass for three minutes by the aid of two glass rods. Wash the cotton, without first pressing it, in a large quantity of water, and when all acidity is removed (indicated by litmus-paper), press it firmly

* The common commercial acid will answer. When very weak, a longer immersion of the cotton is required.

in a cloth. Pull it out into a loose mass, and dry it in a stove at a moderate heat.

The compound thus obtained is not pure fulminating cotton; it always retains a small quantity of sulphuric acid, is less inflammable than gun-cotton, and it leaves a carbonaceous residue after explosion. It has, however, in a remarkable degree, the property of solubility in ether, especially when mixed with a little alcohol; and it forms therewith a very adhesive solution, to which the name of *Collodion* has been applied:

Preparation of Collodion.

Prepared cotton - - - - -	8	parts by weight.
Rectified sulphuric ether - -	125	" "
Rectified alcohol - - - - -	8	" "

Put the cotton with the ether into a well-stopped bottle, and shake the mixture for some minutes. Then add the alcohol by degrees, and continue to shake until the whole of the liquid acquires a syrupy consistency. It may then be passed through a cloth, the residue strongly pressed, and the liquid kept in a well-secured bottle.

Collodion thus prepared possesses remarkably adhesive properties. A piece of linen or cotton cloth covered with it, and made to adhere by evaporation to the palm of the hand, will support, after a few minutes, without giving way, a weight of from 20 to 30 lbs. Its adhesive power is so great that the cloth will commonly be torn before it gives way. The collodion cannot be regarded as a perfect solution of cotton. It contains, suspended and floating in it, a quantity of the vegetable fibre which has escaped the solvent action of the ether. The liquid portion may be separated from these fibres by a filter, but it is doubtful whether this is an advantage. In the evaporation of the liquid, these undissolved fibres, by felting with each other, appear to give a greater degree of tenacity and resistance to the dried mass.

In the preparation of collodion it is indispensable to avoid the presence of *water*, as this renders it less adhesive; hence the ether as well as the alcohol should be pure and rectified. The parts to which the collodion is applied should be first thoroughly *dried*, and no water allowed to come in contact with them until all the ether is evaporated.—*London Medical Gazette.*

ART. IX.—THE CINNABAR MINES OF UPPER CALIFORNIA.

By the Rev. C. S. Lyman.

The mine of New Almaden is situated a few miles from the coast about midway between San Francisco and Monterey, and in one of the ridges of Sierra Azul mountain. The mouth of the mine is a few yards down from the summit of the highest hill that has yet been found to contain quicksilver, and is about 1200 feet above the neighbouring plain, and not much more above the ocean. This hill extends longitudinally in a north westerly direction, decreasing in height; and in various parts of it, for several miles, traces of the ore have been found, and some openings have been made which promise to be valuable. This range of hills consists of a variety of rocks, which I have not yet had an opportunity properly to study. The prevailing one is a greenish talcose rock, which seems to embrace the bed of ore at the New Almaden mine both above and below. A specimen from the rock immediately contiguous to the ore is contained in the box. The ore is interspersed through a yellow ochreous matrix, which forms a bed 42 feet in thickness, dipping northwesterly at an angle of about 45°. The richest ore is at present found in the upper part of the bed, the poorer ores being taken from the lower portion.

This mine, known to the aborigines from time immemo-

rial as a "cave of red earth," from which they obtained paint for their bodies, was first discovered to contain quicksilver about four years since, during experiments made by some Mexicans to smelt the ore for the purpose of obtaining *gold*, which they supposed it to contain. About two years ago it fell into the hands of Barron, Forbes & Co., who sent on hands, tools and funds to commence working it. Unfortunately the vessel fell into the hands of the United States forces, and was confiscated; the operations of the mine were of course delayed till the arrival of Mr. Forbes himself a few months since, with miners, tools, and whatever things he was able to procure in Mexico, to enable him to make a fair experiment on the capabilities of the mine. The great trouble was to obtain suitable apparatus for extracting the ore. At length four potash kettles were found, which were set in a furnace of adobies, with condensers of mason-work immediately adjacent—a wretched apparatus indeed for managing so subtle a thing as mercurial vapour. While I was at the mine the daily mode of working was to fill these pots in the morning with 1600 lbs. (400 to each pot) of the ores of average quality, broken in lumps of the size of apples, put on the covers and *lute* them with a layer of *sand*. The fires were then kept up till near night, when the furnaces were allowed to cool gradually. The next morning the condensers were opened, and the metal dipped up; which usually amounted to from 200 to 30 0lbs. for the four pots. This was a much less per-centage than the assay indicated, and it was obvious that a large portion of metal was lost. The upper parts of the pots and condensers were found to be generally coated with a crust of sulphuret of mercury, of which No. 15 is a small specimen. Mr. Forbes wished to devise some way of extracting the metal without mixing lime with the ore in the roasting, but was unsuccessful. At length a kiln of lime, which occurs in the immediate vicinity, was burned; and I am informed that, mingled

with this, the ores yield a vastly larger per-centage of metal. In the last three weeks about 10,000 lbs. of metal have been extracted with the same apparatus, being a yield of over 50 per cent. Whether the ores were picked or not I cannot say, but presume they were. Between 15,000 and 20,000 lbs. have been extracted in about two months, only six miners have been employed in digging the ore, and the hands of the establishment, all told, miners, furnace-men, wood-choppers, &c. &c., numbering only a score. The mine is probably yielding a net profit of 100,000 dollars a year with its present crude apparatus. With suitable furnaces and iron cylinders or retorts, the mine would easily yield 1,000,000 dollars and upwards. Mr. Forbes sails to Europe shortly for the apparatus necessary. The bed has as yet been followed but a few hundred feet, but the ores grow more and more rich and abundant.

The other mines opened in the vicinity have not yet been sufficiently developed to decide upon their character. Ore has been found in fifteen or twenty other places within a few miles around and within a few days in hills that do not seem to belong to the same range with that which contains the mine already described.

Some ores of silver have also been recently discovered in this region; but I have had no opportunity of procuring any genuine specimens as yet, and whether silver mines worth the working will be found is at least problematical.

There are traces of coal in the country, but nothing of value has yet been discovered.

Gold has been found recently on the Sacramento, near Sutter's Fort. It occurs in small massses in the sands of a new mill-race, and is said to promise well.—Silliman's *Journal*, September, 1848.

ART. X.—ON NAPTHA AND ITS USES.

By Andrew Ure, M. D., F. R. S.

In the last number of this Journal, a notice was inserted about the curative virtue of mineral naptha in Asiatic cholera, as verified by Dr. Andreosky, physician to the commander-in-chief of the Russian army in Circassia. The naptha there employed has been long known as the produce of springs on the north-west coast of the Caspian Sea, not far from the town of Derbend, near the Gulf of Baku, which was incorrectly printed Beker. It is surprising that in the instructions of the Petersburg police board just published, as to the proper precautions and best remedies against cholera, now beninning its ravages in that capital, no allusion whatever is made to naptha, or to Dr. Andreosky's testimony in its favour. Are we hence to infer that the preceding recommendation of that substance is apocryphal, or that it has since lost all credit with the Russian faculty, by whom the police bulletin was prepared?

The soil near Derbent, from which the naptha oozes into wells about thirty inches deep, is a clay marl, which is thoroughly soaked with that fluid. It has a pale yellow colour, like that of Amiano near Parma, in Italy, but has a specific gravity of 0.853, while that of Amiano is only 0.836. Their boiling point is about 305° Fahr. Submitted to distillation, it affords a colourless fluid of spec. grav. 0.728, which boils at about 176° Fahr., but has acquired an empyreumatic odour, very different from that of the native product. Barbadoes tar of the best kind differs from these naphthas only in containing a little more bitumen, but it is equally fragrant. When distilled it yields a similar lighter naphtha, but likewise empyreumatic. The native sub-

stances are composed of 6 atoms of carbon and 6 atoms of hydrogen; or in 100 parts, of 86 and 14, by Hess's analysis.

Mineral petroleum seems to be very different in constitution and qualities from the fetid, factitious tar, derived from the igneous decomposition of pit-coal. The latter, according to Mr. Mansfield, is resolvable into six different substances, which he names *alliole*, *benzole*, *toluole*, *camphole*, *mortuole*, and *nitrobenzole*. I do not believe that a series of similar bodies can be extracted from native bitumen or petroleum. Indeed, he himself informed me that the fluid bitumen now being pumped up so abundantly from the Redding coal mines in Derbyshire, of which I furnished him with a specimen, affords no such distinction of products, a result in accordance with my own experience. These differences between the natural and factitious petroleums lead me to conclude that the former are not the result of igneous action, but of that of water upon carbonaceous matter in the mineral strata. In confirmation of which view it may be observed that not only in the above-named localities, but also at Monte Ciaro near Piacenza, at the Lake of Tegern in Bavaria, near Neufchatel in Switzerland, in the Department of the Ain in France, &c., the bitumen is accompanied with a copious flow of water, on which it floats, and from which it is skimmed.

Petroleum of various shades, from the green of the Barbadoes springs to the pale yellow of Amiano, has been long known to possess certain medicinal properties. The rock-oil of Barbadoes, or as it has been vulgarly but improperly called, Barbadoes-tar, has been found an useful stimulant to torpid bowels, promoting in such a temperament the alvine discharge. Its chief value, however, is as an external remedy in a variety of cutaneous affections. But petroleum, either by itself, or combined with any of its solvent

essential oils or spirits, would in general act rather as an irritant and rubefacient upon the skin in such cases, than as a purifying, cleansing, and soothing application. In this dilemma, the idea occurred of incorporating the green rock-oil with fine curd soap. Thus a truly balsamic compound has been obtained. When the soap, used with water in the usual way, has cleared out the cutaneous pores, a film of the petroleum is deposited in them, powerfully remedial in many of the morbid affections of the skin. Such petrolized soap has been found to be quite a specific in the prickly heat of tropical regions, and of equal efficacy in the fiery eruptions incident to many persons in temperate climates. Hitherto, no method had been devised for mollifying efficaciously the alkalinity of soap, which being, as in the best white curd article, a definite saline compound of stearic acid, and soda in its most caustic condition to the extent of six per cent., cannot fail to excoriate delicate skins. By the present happy invention, each particle of that salt is enveloped with a film of balsam, which mitigates its irritant, without interfering with its detergent quality. Hence we may account for the preference given to the petroline soap by all who habitually use it at the toilet-table.—*Pharm. Journ.*

ART. XI.—ON QUINOIDINE.

By F. Roder.

The author has, in consequence of the results published by Liebig on the constitution of quinoidine, made some experiments to obtain from quinoidine or amorphous quinine the latter in a crystalline state. 1 part of commercial quinoidine is dissolved in 4 parts alcohol of 0·865, and a solution of ½ a part protochloride of tin in 2 parts of water added to it.

This precipitates a dark resinous mass, while the supernatant liquid is but faintly coloured; it is separated from the precipitate, and quickly precipitated with ammonia. The precipitate is then well washed and dried, and exhausted with alcohol as long as this removes anything; the united extracts are again mixed with half the former amount of protochloride of tin, again quickly precipitated with ammonia, and the well-washed and dried precipitate exhausted with alcohol, when an almost colourless solution of pure quinine is obtained, which, carefully saturated with dilute sulphuric acid, affords on evaporation crystals of sulphate of quinine.

In the liquid filtered from the precipitate of protoxide of tin and quinine, as well as in the wash-water, cinchonine is contained, if ordinary quinoidine has been employed which has not been previously purified by precipitation with an alkali. These liquids, containing cinchonine, are precipitated with tincture of galls to obtain the cinchonine in the usual manner.

The precipitated resinous substance still retains some quinine, to obtain which it is dissolved in alcohol, again mixed with a strong solution of protochloride of tin, and then further treated in the above-mentioned manner. The resinous substance so obtained is of an alkaline nature, of a bitter taste, and possesses the peculiar odour of quinoidine; it would probably yield more quinine on further treatment.

The author obtained by this process from two different samples of quinoidine, in one case 43 per cent. quinine, 9 per cent. cinchonine, and 28 per cent. resin; and in the second 40 per cent. quinine, 10 per cent. cinchonine, and 30 per cent. resin; the water amounted to 20 per cent. On precipitating 100 parts of commercial quinoidine in solution with an alkali, the precipitate obtained weighed 69 grs.—*Chem Gaz. from Mittheilungen des Schweizer.*

ART. XII.—ON THE INFLUENCE OF TIME UPON THE FORMATION OF CHEMICAL BODIES.

By Prof. J. Liebig.

When effloresced oxalic acid is mixed with an equal weight of alcohol, this liquid takes up a certain quantity of it, far more at a high than at the ordinary temperature. When the alcohol is saturated hot with it, a portion of the oxalic acid again separates on the cooling of the liquid. These facts are so well known, that they would scarcely deserve special mention, did not this solution gradually lose the above properties. In fact, when a boiling saturated solution of oxalic acid in alcohol, which consequently on cooling deposits a large amount of crystals, is kept for some time at a temperature of 104° to 122°, the quantity of the crystals deposited on cooling decreases after some days, and in the course of several months this liquid no longer affords any crystals. Long before this time a considerable amount of oxalovinic acid and oxalic ether may be detected in the solution; and at last so much of the latter, that on the addition of water it separates in the usual heavy oily drops. On saturating the liquid with chalk, a quantity of lime remains in solution as oxalovinate; on mixing it with ammonia, a considerable quantity of oxamide is obtained. Hippuric acid behaves in exactly the same manner. From a hot saturated alcoholic solution this acid crystallizes in the well-known long needles; but if the solution be kept for several weeks in a warm place, the form of the deposited crystals varies perceptibly, the needles become shorter and shorter, and the acid subsequently separates in cauliflower-like masses, without any distinct form. At last crystals are formed, which melt like an oil at a gentle heat, and possess all the properties of hippuric ether.

It is not every acid, however, that is converted into an ether by contact with alcohol under similar circumstances; benzoic acid may be kept for weeks in a warm spot with alcohol, without the crystals which separate on cooling being altered in form or size; but if a hot saturated alcoholic solution of this acid, which on cooling would solidify to a solid paste, is mixed with a few drops of fuming hydrochloric acid, or, which is preferable, with some alcohol which has been saturated with hydrochloric gas, and the mixture kept at a gentle heat from eight to fourteen days, it entirely loses the property of depositing crystals on cooling. The greater portion of the benzoic acid is converted into benzoic ether, which, on the addition of water and carbonate of soda to remove the hydrochloric and free benzoic acids, separates on the application of a gentle heat in transparent oily drops, which collect at the bottom on cooling. This behaviour of the hydrochloric acid appears to me deserving of consideration, as the action of the very minute quantity present appears to resemble that of the deutoxide of nitrogen in the formation of sulphuric acid. It is known that the chloride of benzoyle mixed with alcohol is instantly metamorphosed into hydrochloric acid and benzoic ether; and it is not impossible that the hitherto enigmatic part which this hydracid takes in the formation of several ethers, depends on the production of chlorine compounds, by the decomposition of which with alcohol the hydrochloric acid is constantly set free again, so that a minute quantity suffices to convert an unlimited amount of acid in ether. I do not, however, mean to deny that this reaction admits of other modes of explanation.

The formation of acetic ether and of enanthic ether in wines on keeping, appears to take place in a very similar manner. It is well known that wines possessing a considerable bouquet, when submitted to distillation, yield a residue of a very disagreeable taste and a distillate con-

taining much alcohol; and that, on mixing the two, a liquid is obtained which has not the least resemblance in taste to the original wine. Geiger observed, that when the distillate mixed with the residue was kept for several years in a cool spot, the original wine was reproduced with scarcely any perceptible difference in taste and odour. It appears, according to this, that what is termed the "bouquet" of wine is owing to the formation of ether compounds; and we may expect that, by a careful examination, their nature will be ascertained; it is not at all doubtful that they can be prepared artificially.—*Ibid, from Liebig's Annalen.*

ART. XIII.—ON THE MANUFACTURE OF SUGAR IN BARBADOES.

By George Fownes, F. R. S.

Professor of Practical Chemistry in University College, London.

The processes of the sugar manufacture of Barbadoes appear to have undergone but little alteration for many years past, and are nearly the same as those employed at a very early period in the history of the colony. A few of the more intelligent and enterprising planters have lately attempted the introduction of improvements with a zeal which does them honor, but from circumstances easily understood the management of the great majority of estates is still the same as in the days of slavery.

The common process of sugar-making is too well known to need a lengthened description. The canes are crushed by a machine consisting of three vertical iron rollers, put in motion by a wind-mill, and the juice, after passing through a strainer, is received into the clarifying vessels, usually of the capacity of 300 or 400 gallons, where it receives the usual dose of lime or "temper," and a sufficient

degree of heat to occasion the separation of an abundant *coagulum* of insoluble matter, part of which rises to the top in the form of scum, while the remainder subsides as a thick muddy deposit to the bottom of the vessel. The clear liquor is drawn off by a cock into one of the larger evaporating pans, and rapidly boiled down until its bulk is considerably reduced. From thence it is transferred to a smaller pan, and still further concentrated. The scum which constantly arises during the boiling, is removed by skimming, and reserved, together with the feculencies, separated in the clarifying vessel, for the manufacture of rum; it forms in fact, the ferment to the saccharine liquid, and replaces the yeast employed by the distillers of Europe. The concentration of the cane-juice is completed in the smallest of the series of pans, whence it is emptied or "skipped" by an ingenious contrivance, first into a copper cooler, and afterwards into a large shallow wooden crystallizing vessel, and stirred from time to time. In a few hours, the dark pasty mass of crystallized sugar and fluid molasses is found sufficiently firm for "potting" or "curing;" it is put into hogsheads perforated with a few holes, and there allowed to drain for a period of time varying from two or three days to a fortnight, the molasses being received into an open cistern beneath, covered with a strong framing of joists, upon which the hogsheads rest. The sugar is lastly "headed up" for shipment, and sent into commerce.

In the arrangement of the boiling-house plan, the evaporating and clarifying vessels are ranged in a row, and heated by a single fire, which is made immediately under the last and the smallest, the series of four or five terminating with the clarifier; they are usually made of copper, and surmounted with leaded slopes to retain the boiling and frothing liquor, which is transferred from one to the other, partly by means of a sluice in the slope, and partly by baling. The fuel is the "megass" or crushed cane of the preceding year, dried in the sun, and carefully preserved in

a shed or in stacks; it burns rapidly, producing a powerful flame, which maintains the whole of the evaporating pans in a state of rapid and violent ebullition, besides imparting the requisite degree of heat to the liquor under clarification.

The juice, as it flows from the crushing-mill, is frothy, turbid, and foul, but very pale in colour; after clarification carefully conducted, it becomes quite clear, but acquires the light amber colour of pale sherry or Madeira wine. In the evaporating vessels it becomes darker and darker, until when removed from the last and smallest pan to the cooler, it nearly resembles in colour and consistence ordinary tar. After crystallization, however, the greater part of the dark colouring matter drains away in the mother-liquor or molasses, leaving the crystals in the yellowish or brownish state familiar to every one in common raw sugar. Even this degree of colour, however, is in great part superficial, for if the crystals be washed with a little water or white syrup, they become nearly white.

In the process of tempering, considerable judgment is required; enough lime in the state of lime-water, or milk of lime, should be added to render the liquid quite neutral, or perhaps better, with a very slight tendency to alkalinity. An excess of lime does great mischief, darkening still further the liquor, and injuring the product of crystallized sugar both in quality and quantity. From the variable nature of the cane-juice, according to the season, wet, and other circumstances, the quantity of lime required is found to vary greatly.

The skill and judgment of the sugar-boilers are again exercised in deciding on the most advantageous degree of concentration to which to bring the syrup in the last pan. If it be not pushed far enough, the product of sugar is greatly diminished; if, on the contrary, it be left for even a very few minutes too long over so fierce a fire, it is so far altered in properties as to be in great part rendered uncrystallizable. In both this and the clarification process, the

usual, perhaps only, guide, is experience acquired by practice.

Such is the plan of operations yet almost universally followed, with occasional slight and inconsiderable variations, not only in Barbadoes, but in most of the West India Colonies. The greatest variations are in the crushing-mill; the power of the wind is used in Barbadoes, where it commonly blows with great strength and regularity during the three or four spring months of crop time. In the mountainous islands water-power is had recourse to, and where neither of these is available, steam-power is used; coal being imported from England for the purpose of heating the boilers, and the megass reserved for the evaporation of the juice.

Before pointing out the defects of the present system of manufacture, it will be necessary to say a few words concerning the chemical composition of cane-juice, as far as it is known. Our information on this important subject is yet defective; it may be hoped, however, that the researches which Dr. Shier, aided by the wise liberality of the government of British Guiana, has been enabled to make, added to those of other inquirers in the same field, may shortly throw considerable light on this great fundamental point.

Fresh cane-juice, from mature and healthy canes, possesses a very pale yellowish grey colour, a faint, fragrant odour, and a powerfully sweet and somewhat fruity taste, to most persons very agreeable. It is somewhat thick and clammy, having a sp. gr. ranging from 1.070 to 1.090, and in some cases higher. It is turbid or opalescent from finely-divided suspended matter, and filters through paper with great difficulty and little increase of transparency. This turbidity is commonly a little increased by boiling, and sometimes a few small flock separated. The juice is very faintly, though decidedly acid to delicate litmus paper, which re-action is not altered by boiling. It is unaffected by acids, with the

exception of nitric acid, which occasions after a time a very slight precipitate. Corrosive sublimate gives a similar result. The ordinary tests discover the presence of salts of lime and magnesia, sulphuric and phosphoric acids, potash and soda, in variable quantities. A large addition of alcohol throws down flocks of a substance resembling gum or dextrine, and, lastly, a few drops of sulphate of copper, and an excess of caustic potash occasion on heating a very abundant red precipitate of suboxide of copper, the well known mark of the presence of glucose or grape sugar.

When lime-water is added in slight excess to cane-juice a copious precipitate falls, which consists of an azotized organic substance in combination with lime, waxy or fatty matter, and the phosphates of lime and magnesia, the latter constituting more than a fourth part of the dried mass. A similar precipitate is caused by potash and ammonia. The juice therefore appears to contain the following substances, cane-sugar in great quantity ; a notable amount of glucose, or sugar of fruits ; gum or dextrine ; phosphates of lime and magnesia retained in solution ; some other salt of lime and magnesia ; sulphates and chlorides ; potash and soda ; and, lastly, a peculiar azotized matter belonging to the albuminous family hitherto undescribed, capable of forming an insoluble compound with lime, not coagulable by heat or acids, and readily putrefiable. Of ordinary vegetable albumen there are but indistinct traces, and of caseine or legumine none.

Cane-juice, left to itself a few hours at the ordinary temperature of tropical countries (80° or thereabouts,) becomes very turbid, begins to disengage gas, and deposits a copious flocculent precipitate. In this state it is acid to test paper, and offensive to the smell. The boiled juice keeps better, and that which has undergone the lime-defecation may be kept unchanged for twenty or twenty-four hours, after which period it also becomes turbid and spoils.

When lime-water is added to fresh and heated juice until reddened litmus paper shows the slightest possible trace of alkalinity, the whole heated to the boiling-point, and after standing a few minutes placed upon a paper or cloth filter, a perfectly clear, pale, yellow liquid runs through, leaving on the filter a greenish-grey mass, having the composition already mentioned—namely, consisting chiefly of azotized organic matter combined with lime, and the phosphates of lime and magnesia. The filtration is particularly rapid and easy. The clear liquid evaporated to a syrupy state over the open fire throws up no scum whatever, and colours but little in this condition, exposed to spontaneous evaporation in a shallow vessel, it furnishes a mass of crystallized sugar sometimes perfectly dry, and sometimes accompanied by more or less yellow uncrystallizable syrup, in which the presenceof common salt in large quantity can be recognized, this body having, as is well known, the power of forming with cane-sugar, a highly soluble and deliquescent compound. Even when the whole crystallizes, however, and and very little common salt can be detected, the resulting sugar absorbs water when exposed to a very damp atmosphere, and becomes moist or wet, indicating the presence of some deliquescent material in the juice.

The statement, therefore, that good cane-juice contains no saccharine matter but crystallizable sugar, and that the production of molasses or uncrystallizable syrup is wholly due to the excessive heat employed in the common process, must be received with some reservation. No doubt crystallizable sugar to a great extent is destroyed in the boiling, and especially in the last pan, where the boiling point of the liquid rises 235° or 240°, or even higher, and that the result of such mismanagement is a very great increase in the proportion of uncrystallizable mother liquor; but the whole is not so produced. Unless, therefore, means could be devised for removing the deliquescent compounds which pre-exist

to a greater or less extent in the juice, the production of molasses could never be entirely suppressed, although it might be greatly diminished in amount, and the quantity of crystallized sugar increased in the same proportion, its colour and quality being at the same time so far improved as to enable it to compete for many purposes with refined sugar.

The imperfections of the common method of manufacture in use may now be noticed, and remedies suggested.

In the first place, the crushing-mills are imperfect and do not express the whole of the juice separable by such means. The spongy substance of the cane, retaining liquid with great obstinacy, requires a very good and careful adjustment of the rollers, and the means of regulating the rapidity of motion, to yield the maximum of juice, and these conditions are very far from being fulfilled by the powerful although rude windmills of Barbadoes. The result is, that instead of a quantity of juice making up 70 or 75 per cent. of the weight of the canes, the quantity yielded by mills of better construction, that obtained rarely exceeds 50 per cent. and sometimes falls below it. The total quantity probably amounts to 85 or 90 per cent., the whole of which of course cannot be obtained by any degree of pressure however powerful. Every endeavour, however, should be made to approximate to this point as nearly as possible. A loss of 20 or 30 per cent. of juice involves a loss of 20 or 30 per cent. of sugar. It will be wise economy, therefore, to spare no expense in providing a mill sufficiently perfect and powerful to do its duty. The power to be applied must depend upon circumstances, and will become a simple question of economy; provided it be sufficient and capable of regulation its nature matters little.

The common defecation process, in careful hands, seems susceptible of little improvement. Many other substances than lime have been proposed and tried with more or less

success,* some of which, in particular states of the cane juice, may prove very useful; but for general purposes nothing seems to answer so well as neutralization by lime, either in the form of lime-water or milk of lime, added until the slightest possible tendency to alkalinity, as ascertained by delicate reddened litmus-paper, is perceivcd. The juice should be somewhat heated before the lime is added, and afterwards raised quite to its boiling point. The fire is then to be withdrawn, and the whole allowed to rest a short time.

The next step is an innovation. It consists in filtering the juice before evaporation, with a view of removing the whole of the insoluble feculent matter. This may be done with the greatest ease. The cloth-filters employed by sugar-refiners, or in small works, a basket or perforated metal cullender, covered with a linen or woollen cloth, would suffice. A charcoal filter would no doubt be very efficacious, but more expensive and troublesome in use, and mechanical filtration only is really needed. The defecated cane-liquor would thus be obtained perfectly clear, which is never now the case, and on concentration would yield no scum: the labour of skimming and the loss of juice so carried away, would be avoided. The feculent matter on the filter might either be employed as ferment in the rum-distillery, or more advantageously transferred to the compost-heap as a most valuable manure. The progress of civilization and morals will probably bring about a diminished demand for rum, which already in many cases is only made for the purpose of employing materials difficult to dispose of, or which would otherwise be wasted, namely, molasses and the skimmings of the coppers. By improved methods of manufacture, however, the molasses might be diminished to an in-

* See Dr. Evan's Sugar Planter's Manual, a most valuable work, which should be in the hands of every one engaged with, or interested in, the manufacture of sugar.

significant quantity, which might find a ready market, or be advantageously used upon the estate in feeding stock, now so grievouslyly neglected, while the increased yield of sugar of superior quality, for which the demand at home might become almost indefinite, being only limited by the price, would amply remunerate the enterprising grower.

The filtered liquor must now be concentrated to syrup, which may be done over the open fire, or by steam of moderate pressure circulating in a spiral of copper pipe laid at the bottom of the evaporating vessel, which should be large and shallow, and as unlike as possible the tea-cup shaped coppers now in use. Here it may be boiled down rapidly until the temperature of ebullition rises to 225° or thereabouts, without injury to the syrup. When cold, it will then have a density of 1.33, or near it, and mark the 38th degree of Baumé's hydrometer. Beyond this point it will not be safe to go. The concentration of the syrup to the crystallizing point must be completed either by the vacuum-pan—the most perfect of all means, or by one of the several substitutes for that invaluable invention, of which an account will be found in Dr. Evan's *Manual*, and in other works on the subject. Among these, Gadesden's apparatus may be mentioned as having been used with some success on an estate near Bridgetown, the difference in colour and grain of the sugar made by this machine and that made by the old process over the open fire, at the same time and from the same canes, being quite extraordinary. The chief difficulty attending the use of the vacuum-pan in Barbadoes will probably arise from deficiency of water for condensation; by sinking wells, however, with the precaution required by the peculiar geological structure of the island, this may be overcome.

The old-fashioned flat shallow crystallizing vessels are exceedingly defective, inasmuch as they permit the too rapid cooling of the syrup, and thus hinder the formation of bold and distinct crystals essential to a good process.

The confusedly crystalline pasty mass obtained drains with difficulty, and holds back the last portions of molasses with great obstinacy. This should be by all means avoided, a regular and distinct crystallization should be encouraged by collecting the concentrated syrup in deeper vessels, avoiding too much agitation, and allowing it to remain a longer time than usual before transferring it to the curing house, where it should be thoroughly and completely drained. Under the present system, the loss of molasses and sugar, the result of hasty and imperfect curing, is almost incredible. During the passage home, the leakage from the hogsheads into the hold of the ship is enormous; the bilge-pumps throw molasses almost as pure as that from the cistern of the sugar-boiler, and this it must be remembered is not simply an uncrystallizable mother-liquor containing the impurities of the cane-juice, but a syrup yet rich in crystallizable sugar. It is quite distressing to witness such culpable waste of that which has become one of the first necessaries of life, through the haste and carelessness of those who would reap the earliest and largest benefit from a better management. The fact is, that sugar should be sent home so dry, that it might be put in bags. It is already so with much of the foreign sugar now imported. Stove-drying might even be tried with advantage. At any rate, the present lamentable and wilful waste of property must be by some means or other avoided.

Again, the molasses-cistern of an ordinary sugar house has been with truth described as a receptacle for dirt and vermin. Sufficient attention is not paid to the preservation of that which has been collected; much of it is wasted and lost in various ways; the remainder being converted into rum, which, in many cases, from its inferior quality, cannot be exported, but gets consumed in the colony, being sold at a very low price to the working population, to which it becomes one of the most powerful and fertile sources of demoralization and ruin. This is notoriously the case in

Barbadoes, where the licensed dram-shops for the sale of this fiery poison exceed in number six hundred. The preferable method would be to collect it with care in puncheons as it flows from the sugar in the curing-house, and in this manner preserve it until after crop-time, that is, until the leisure time of the year, when it might be advantageously re-boiled in the vacuum-pan, and an additional quantity of sugar extracted.

To recapitulate: the attention of the intelligent and enterprising planter should be directed to the following points:

1. To obtain by the use of a properly constructed mill, the greatest possible amount of juice from the cane.

2. To clarify and filter this juice with expedition, and to evaporate it rapidly either over the open fire, or by steam-heat, as far as it can be done with safety.

3. To complete the concentration in a vacuum-pan, or by other means, at a moderate temperature, not hurtful to the sugar, and to facilitate the natural process of crystallization, so as to obtain a sugar of large and distinct grain.

4. To drain and dry the sugar perfectly, and to save all the molasses.

If the sugar be desired *white*, it can easily be obtained in this condition, by filtering through a bed of animal charcoal the thin syrup ready for the vacuum-pan, according to the practice of refiners, and by afterwards washing the crystals when thoroughly drained with white syrup. In this manner, raw sugar will be obtained almost equal in colour and purity to refined sugar, but at an increased expense, as the charcoal soon loses its decolourizing power, and requires re-burning, and the washing process consumes a considerable quantity of pure sugar. The propriety of adopting these additional measures will depend entirely on the price such whitened sugar bears in the market. At present an additional duty is levied on such; it is to be hoped, however, that this most injudicious increase, may, on a proper representation of the facts of the case, be remitted.

The most economical and advantageous mode of heating the vessels of a sugar establishment, would undoubtedly be by the use of steam—a single boiler, or set of boilers, according to the size of the works, furnishing steam to each, exactly as may be required, being shut off in a moment when no longer wanted, and directed elsewhere with equal ease. To heat the vacuum-pan, steam must be used; power is required to work the air pump, or to set in motion the wheel, in Gadesden's apparatus. To furnish enough steam to heat, in addition, the defecating and evaporating vessels, will not involve a very great increase of boiler-space or consumption of fuel, and will be attended with the very great advantage of permitting the application of the whole of the megass to the soil as manure. At present, coal cannot be landed at Barbadoes from England under 30s. or 35s. per ton; even at this high price its use would be, without doubt, economical. It might probably be obtained much cheaper from Cape Breton in British North America, or from the United States. The extensive exportation of coal from England is a policy so questionable, that diligent search should be made in other available quarters for this invaluable fuel, a scarcity of which may, ere very many more years have past, be felt at home.—*Pharm. Jour.*

ART. XIV.—ON THE MANUFACTURE OF OXALIC ACID.

By Mr. Lewis Thompson.

As no accurate account of the decomposition which ensues in the manufacture of oxalic acid has yet been published, that I am aware of, the following experiments may tend perhaps to draw attention to this subject.

The apparatus employed, consisted of a large glass retort, placed in a water-bath, and luted to a tubulated receiver, from the opening in which a tube passed into a two-necked

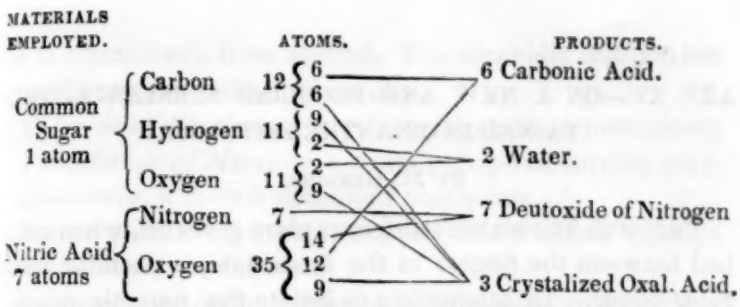
bottle, containing a solution of ammonia; this bottle was connected by a tube, with another of the same size and form, containing a solution of nitrate of lime, from which an exit tube passed, which dipped under water, and allowed the escape of the incondensible gaseous matter.

The temperature of the water-bath was maintained as nearly as possible at 125° Fahr., for forty-eight hours in each experiment, after which the solution of oxalic acid was set aside for two days to crystallize. The crystals were allowed to effloresce in a drying stove, so as to remove all excess of nitric acid; they were then dissolved, recrystallized, dried and weighed.

The amount of carbonic acid was determined by mixing the solutions of ammonia and nitrate of lime after each experiment, allowing the carbonate of lime to settle for twenty-four hours, after which it was washed, dried, and weighed. The sugar employed was the best refined white, and it lost nothing in weight by prolonged exposure to a temperature of 212°. The nitric acid was pure, and of specific gravity 1.245 at 60°; it contained as nearly as possible, one-third of its weight of dry acid, as was proved by the amount of pure carbonate of soda which it neutralized. The following table exhibits the results of eight experiments, showing the amount of sugar and dilute nitric acid employed, and the quantity of oxalic acid and carbonic acid produced. The liquor from the receiver and the mother-liquor of each experiment being added to the one following:

	EMPLOYED.		OBTAINED.	
	Sugar in ounces.	Dil. Nitric Acid in ounces.	Oxalic Acid in ounces.	Carbonic Acid in ounces.
No. 1	28	184	17½	20½
2	28	184	32¼	22¼
3	28	184	30	21
4	28	184	29½	21½
5	28	184	31¼	22
6	28	184	30½	21
7	28	184	30¼	21½
8	28	184	31	21½

A large quantity of mother-liquor remained, from which no crystals were attempted to be obtained, as these may be set against the small produce of experiment No. 1. If then we omit this experiment altogether, we shall have an average of the seven following, showing that 196 of sugar and 1288 of diluted nitric acid, have produced 214¾ of oxalic acid and 150¾ of carbonic acid, and that the proportion of carbon in the oxalic acid obtained almost exactly equals that in the carbonic acid, and that by the action of nitric acid in the way described, one-half of the carbon of any given quantity of sugar, is converted into oxalic acid, and the other half into carbonic acid. I have made many experiments with nitric acid of various densities and at various temperatures, but without obtaining in any instance so large a produce of oxalic acid, as with acid of the strength indicated. When strong acid is employed, the temperature rises too high, and a quantity of formic acid is occasionally produced, which distils over into the receiver, and materially diminishes the produce of oxalic acid. From these experiments it would appear that no more than 124lbs. of oxalic acid can be obtained from a cwt. of sugar. This, I am aware, is much below the quantity generally supposed to be produced on the large scale, and which is stated to vary from 135 to 140 lbs. for the cwt. of sugar; such acid is however contaminated with nitric acid and mother liquor, and is moreover decidedly damp, as shown by the manner in which the crystals cling to the sides of the bottle in which they are contained—some allowance must also be made for the tendency to exaggeration which prevails in our manufactories. Of this at least I am sure, that in some hundreds of attempts conducted on a pretty large scale, I have never once exceeded the amount here stated (124 lbs.) when the acid was properly purified and freed from adhering moisture. The following diagram in my opinion represents the nature of the ultimate decomposition which ensues in this manufacture, although other substances are unquestionably produced in the first instance :—



These proportions do not greatly differ from those employed in practice by oxalic acid-makers, when allowance is made for the loss of nitric acid incidental to their mode of manufacture. The following is the general proportion of materials employed :—

Sugar - - -	112 lbs.
Nitrate of potash -	560 lbs.
Sulphuric acid, - -	280 lbs.

which are said to produce 135 lbs. of oxalic acid, and 490 lbs. of sulphate of potash or sal enixum.

Experiment has proved to me that the first change produced, is to convert the cane-sugar into grape-sugar, and as the first portions of gas evolved consist almost entirely of nitric oxide with little or no carbonic acid, it is clear that some compound is generated in the commencement of this process, which contains the elements of sugar united to an excess of oxygen—the above diagram must therefore be looked on as merely explanatory of the ultimate change.—*Pharm. Journ.*

ART. XV.—ON A NEW AND PECULIAR SUBSTANCE CONTAINED IN ŒNANTHE FISTULOSA.

By M. Gerding.

This well-known umbelliferous plant gives off, when rubbed between the fingers in the fresh state, a peculiar narcotic odour. In attempting to isolate the narcotic principle, no result was obtained by distilling with caustic potash; I therefore extracted 20 lbs. of the fresh herb repeatedly with alcohol of 0.863 spec. grav. at the ordinary temperature, and freed the intensely-green extract from chlorophyle, &c. by acetate of lead. The liquid filtered from the green precipitate was of a light yellow colour, and possessed a still more penetrating odour, resembling turnips. The excess of lead was removed from the liquid by sulphuretted hydrogen, filtered, and then evaporated at a gentle heat to within one-eighth of its volume, when a peculiar resinous substance began to separate, which increased on further evaporation, so that the whole was finally converted into a syrupy, resinous, viscous mass, which amounted from 20 lbs. of herb to between 4 and 5 grms. The blackish-brown substance is somewhat tenacious, has an extremely disagreeable irritating taste, and a very penetrating narcotic odour, which is not easily got rid of from the hands. At 54° F. it is of a tenacious consistence; at a somewhat higher temperature it becomes soft, and begins to melt at 68°. It is not soluble in water, sparingly soluble in alcohol at the ordinary temperature, but perfectly soluble in 12 parts of it between 113° and 122°, equally in acetic acid at the same temperature, sparingly soluble in ether, and insoluble in sulphuric and hydrochloric acid; nitric acid destroys it, producing a red colour. I propose the name of *œnanthine* or œnanthic resin forthis resinous substance.

This substance contains nitrogen, as ammonia was evolved on treating it with caustic potash; it was found impossi-

ble to crystallize it from alcohol. The alcoholic solution has an acid reaction. It affords with—

Chloride of Platinum, a yellow *crystalline* precipitate.

Perchloride of Mercury, a white percipitate turning gray.

Ammonia, a brown flocculent precipitate.

Potash produces a turbidness, and when added in large quantity separates the resin.

Carbonate of Soda produces a yellowish-brown pulverulent precipitate, as does *carbonate of ammonia*.

Nitrate of Silver causes a considerable reddish-brown precipitate.

Sulphuric Acid precipitates a brown powder, as does also *hydrochloric acid*, only the colour is somewhat more yellow.

A slight excess of ammonia added to a solution of the œnanthic resin in acetic acid produces a brown pulverulent precipitate, which possesses the chemical properties of the substance above described, but is not resinous. To this substance the author gives the name of *œnanthine*, and supposes it to be combined in the œnanthic resin with an acid; since on the distillation of an alcoholic extract of the resin, resin constantly separates in the retort during the operation, whilst above the level of the liquid a whitish ring is deposited, which is volatilized and passes into the distillate. This forms a white, milky, faintly-acid liquid, with an odour similar to the œnanthic resin, but considerably milder and more agreeable. The author supposes it to contain a volatile acid, but was prevented, from want of material, from extending his inquiries further on the subject. It has a powerful effect upon the animal system; half a grain administered to a full-grown person produces a long-continued irritation in the palate, followed by a hoarseness of two to three hours, duration; one grain sufficed to produce a slight vomiting. It may therefore prove interesting in a therapeutical point of view.—*Chem. Gaz. from Journ. für Prakt. Chem.*

ART. XVI.—ON THE ACID CONTAINED IN THE LEAVES OF ILEX PARAGUAYENSIS.

By Dr. F. Rochleder.

The leaves of this plant, known under the name of Paraguay tea, are used in South America in the same manner as tea in Europe and several countries in Asia. Stenhouse has found that the crystalline substance contained in it is identical in its composition and properties with caffeine. To ascertain the nature of the acid which accompanies the caffeine, in Paraguay tea, and furnishes the material for its formation, I examined a small quantity of the tea in the following manner:—The tea was rubbed to a powder, and exhausted in a stoppered vessel with alcohol of 0.951 spec. grav., which after some hours was replaced by a fresh quantity as long as it acquired a yellow colour. The yellow solution was precipitated with an alcoholic solution of acetate of lead, as long as the precipitate exhibited a somewhat dirty-yellow colour. This, separated by filtration, dries to a dark greenish brown mass. The yellow filtered solution is now entirely precipitated with an alcoholic solution of acetate of lead, and the beautiful yellow precipitate washed with alcohol upon the filter, suspended in alcohol, and decomposed with sulphuretted hydrogen. After expelling the excess of sulphuretted hydrogen, the liquid was poured into a large quantity of a solution of acetate of lead in alcohol, the precipitate washed with alcohol, and dried at 212°. This lead salt afforded on analysis the following numbers:—

Carbon - - - - -	22.84	14 =	1050	22.63
Hydrogen - - - -	2.20	8	100	2.15
Oxygen - - - - -	15.64	7	700	15.10
Oxide of lead - - -	59.3	32	2789	60.12

Deducting the amount of oxide of lead, there remains, for the acid C 56.1, H 5.4, O 38.5, which is the composition of caffeo-tannic acid.

To convince myself of the identity of these two acids, I decomposed a portion of the lead salt which had been employed for the above analysis with sulphuretted hydrogen. The solution filtered from the sulphuret of lead was slightly yellow, acquired a dark reddish-yellow colour with ammonia, potash or soda, and was coloured dark green with perchloride of iron. Mixed with an excess of ammonia and exposed to the air, the liquid became dark green, which colour was converted into brown by the addition of acetic acid. The brown acid liquid afforded with a solution of acetate of lead a dark blue precipitate, which was coloured red by sulphuric acid. All these reactions agree with those presented by caffeo-tannic acid under the same circumstances; consequently the identity of the acid contained in the leaves of *Ilex Paraguayensis* with that existing in the berries of coffee is proved.—*Ibid. from Ann. der Chem. und Pharm.*

ART. XVII.—ON THE COLOURING MATTERS OF MADDER.

By Dr. Schunck.

On treating finely-ground madder roots with boiling water, a brown fluid is obtained having a taste between bitter and sweet. In order to extract all the substances capable of solution in water, about sixteen quarts of water are required for every pound of madder. To this fluid any strong acid, such as sulphuric or muriatic acid, is added in slight excess. Nitric acid must not be used for the purpose. Oxalic acid is best adapted, as it can afterwards be completely removed by chalk. The acid produces a dark brown precipitate, which is separated by filtration, and washed with water until the excess of acid is removed. The percolating fluid is yellow. This brown precipitate consists of seven

vegetable substances, viz. alizarine, rubiacine, alpha-resin, beta-resin, rubian, pectic acid and oxidized extractive. The examination of the fluid was next made; it was found to contain xanthic acid, madder-yellow and sugar. The continued investigation of the subject has led to the conclusion that there is but one colouring matter in madder, *i. e.* the alizarine; and that the substance which was thought to be a colouring matter, viz. rubiacine, is not so.

It is known that after madder has been employed for dying, it still contains colouring matter, and that the article garancine is manufactured from this. By treating this substance with boiling muriatic acid, it was found to contain lime, magnesia, oxalate of lime, phosphate of lime, alumina and peroxide of iron. After these salts were separated, boiling water extracted a large quantity of colouring matter, which would dye mordanted cloth quite full, and of the same colour as madder itself, thus showing that it contains alizarine. Alizarine is found to be composed of—

Carbon - - - - - - -	56.97
Hydrogen - - - - - -	4.19
Oxygen - - - - - - -	38.84

or, in fact, of carbonic acid and water. Alizaric acid is formed by treating alizarine with concentrated persalts of iron or nitric acid. The salts of this acid are mostly soluble. Alizarate of lime is prepared by neutralizing alizaric acid with carbonate of lime, and evaporating to crystallization. It crystallizes in prisms possessing great brilliancy. Alizarate of baryta, prepared in the same way by means of carbonate of baryta, crystallizes in silky needles. Alizarate of silver, prepared by double decomposition, is soluble in boiling water, from which it crystallizes as the solution cools. Alizarate of lead is insoluble. By subjecting alizaric acid to heat, it is volatilized, and forms a sublimate in the shape of long white needles, to which the name of pyro-alizaric acid is given. By solution in water, pyro-alizaric acid appears to be again converted into alizaric acid. Rubiacine was

found to be C^{31} H^{9} O^{10}, and rubiacic acid C^{31} H^{9} O^{16}. Alpha-and beta-resin were next examined, as were also the other constituents; and the author then proceeded to examine the part which each material plays in the process of dyeing; from which it is satisfactorily proved that alizarine is the substance producing colour; and the advantages of converting madder into garancine consist in removing the resins and those bodies which are not only useless but injurious, and in separating alizarine from those salts with which it exists in the madder root in close combination.—*Chem. Gaz.*

ART. XVIII.—ON COMMON SALT AS A POISON TO PLANTS.

By W. B. Randall.

The following notice is presented as being likely to afford a useful practical caution to those interested in the cultivation of plants. In the month of September last, three or four small plants in pots were shown to the writer, nearly or quite dead; and he was at the same time informed that their destruction was a complete mystery to the party to whom they belonged, and that Dr. Lindley had expressed his opinion, from the examination of a portion of one sent to him, that they were poisoned. Having searched in vain for any strong poison in the soil, and in the plants themselves, he inquired more minutely into the circumstances of the case, and found that these were only specimens of many hundreds of plants both in the open air and in green-houses (but all in pots), which exhibited in a greater or less degree, the same characteristics. The roots were completely rotten, so as to be easily crumbled between the fingers; the stems, even in young plants, assumed the appearance of old wood, the leaves became brown, first at the point, then

round the edge, and afterwards all over; while the whole plant drooped and died. At least 2000 cuttings, in various stages of progress, and 1000 strong healthy plants, had been reduced to this condition, including different varieties of the fir, cedar, geranium, fuchsia, rose, jasmine and heath. The sight of this wholesale destruction, coupled with the fact that the whole were daily watered from one particular source, suggested the conclusion that the cause of the evil must reside in the water thus used; and this was accordingly examined. It yielded the following constituents, making in each imperial pint of 20 fluid ounces nearly 9½ grains of solid matter entirely saline, without any organic admixture :—

Carbonate of lime - - - - -	0.600
Sulphate of lime - - - - -	0.462
Chloride of calcium - - - - -	0.200
Chloride of magnesium - - - -	1.252
Chloride of sodium - - - - -	6.906
	9.420

The mould around the plants and infusion of the dead stems and leaves also afforded abundant evidence of the presence of much chloride of sodium. Further inquiry showed that the well from which the water was procured had an accidental communication, by means of a drain, with the sea; and thus became mixed with the salt water from that source, and had been used in this state for some weeks, probably from two to three months. From about that time the plants had been observed to droop; but it was not until nearly the whole of a valuable stock had been destroyed, that any extraordinary cause of the evil was suspected. To place it beyond doubt that the water was really the cause of the mischief, twelve healthy fuchsias were procured from a distance, and divided into two parts, half being watered morning and evening with the water in question, and the others with rain-water. In a week the six plants watered from

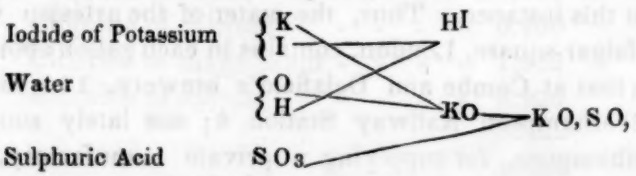
the well had turned brown, and ultimately died, while all the rest remained perfectly flourishing. Assuming from these facts, that the common salt in this water was the chief cause of the results described, it is proved that water containing about 7 grs. of salt in each pint is, in its continued use, an effectual poison to the weaker vegetation; or that when a soil is continually watered with a weak solution of salt, it gradually accumulates in it until the soil becomes sufficiently contaminated to be unfit to support vegetable life. In either case an interesting subject of inquiry is suggested—What is the weakest solution of salt which can produce in any measure this poisonous effect? or, in other words, at what degree of dilution does the danger cease? For salt is an important natural constituent of much spring water, quite independent of any infiltration from the sea, as in this instance. Thus, the water of the artesian well, Trafalgar-square, London, contains in each gallon about 20 grs.; that at Combe and Delafield's brewery, 12.; that at Wolverhampton Railway Station, 6; one lately sunk at Southampton, for supplying a private manufactory, 40. May it not be asked, whether the subject of the suitableness of waters in general for the various purposes to which they are applied, be it in manufactures or for steam-engines, domestic purposes or drinking, is not worthy of a greater share of scientific attention than it has hitherto commanded?—*Ibid.*

ART. XIX.—PHARMACOPŒIA TEST FOR IODIDE OF POTASSIUM.

A Correspondent, D. B., of Aldersgate Street, has directed our attention to one of the tests described in the notes to the Pharmacopœia for *Iodide of Potassium*, which is thus expressed,—"*Sulphuric acid and starch, added together, it becomes blue.*" "The truth is," says our correspondent "that the above is a test of the impurity, not of

the purity, of the article, for on adding sulphuric acid and starch to a solution of *pure* iodide of potassium, the blue colour is not produced; but if the specimen contain iodate of potash or free iodine, the blue colour will be developed."

This subject had been previously brought under our notice. It appears that some iodide of potassium was recently condemned by a purchaser as bad, the manufacturer being told, to his astonishment, that it contained no iodine, the test described in the Pharmacopœia having failed to indicate the presence of that body. It was found, however, that the only peculiarity in the salt consisted in its being very pure. On adding sulphuric acid to a solution of pure iodide of potassium, water is decomposed together with the salt, yielding sulphate of potash and hydriodic acid, as represented in the following diagram:—



Hydriodic acid (H I) is a colourless compound which does not affect the colour of starch, and therefore, on adding starch to the above mixture the blue iodide of starch is not formed. But hydriodic acid is a very unstable compound; it speedily undergoes decomposition, iodine being set free, which colours the solution and gives the characteristic blue colour with starch. If, therefore, instead of adding the sulphuric acid and starch *together*, the acid be added first, and the mixture allowed to stand for some minutes before the addition of the starch, the presence of the iodine will be made manifest. It might be supposed that the same effect would ensue if the acid and starch were added simultaneously, and the mixture allowed to stand for some time, but experience shows that this method of applying the test will not answer.

It is evident from what has been stated, that the Pharmacopœia test is a bad one. Sulphuric acid is not the best

substance to use for decomposing the iodide of potassium and setting free the iodine. Nitric acid might be used with better success, especially if it contain nitrous acid, as it generally does; but chlorine water, or gaseous chlorine, will be found to be better than either, the whole of the iodine being thus instantly set free. The best method of applying the test is to make a weak solution of the salt to be tested in distilled water, to add to this some cold solution of starch, to allow some chlorine gas to flow from the mouth of a bottle on to the surface of it, and so slightly agitate the liquid. The blue compound will thus be instantly developed. It is not necessary that the chlorine used for this purpose should be pure; the gas occupying the upper part of a bottle containing chlorine water, will answer the purpose perfectly well, the stopper being removed, and the bottle partly inverted over the edge of the test-glass, so that the heavy gas may flow out. This is the most delicate way of testing for the presence of iodine, and should be adopted where the quantity to be detected is very small; but in applying the test to iodide of potassium, delicacy of indication is not required, as iodine is, or ought to be, the the most abundant constituent of the salt. Chlorine water, or reddened nitric acid, might, therefore, be used in this case with the same effect as gaseous chlorine.

Our correspondent is correct in saying that the Pharmacopœia test does not indicate the purity, but the impurity of the salt. The test could not have been intended for the detection of impurities, but merely to show that iodine is present; yet it has happened, unfortunately, that when applied according to the instructions of the Pharmacopœia, it fails to afford even this indication, if the salt be perfectly pure. Perfectly pure iodide of potassium, however, is rarely met with in commerce. The process by which the salt is usually made by manufacturers, consists in heating together a solution of caustic potash and iodine, in which case iodate of potash is necessarily produced at the same time as the iodide; and although the salt is subsequently

exposed to a dull red heat, with the view of decomposing the iodate, yet there is generally a small portion of iodate left in the product, the presence of which causes the immediate liberation of iodine on the addition of sulphuric acid.

Thus, although the Pharmacopœia test is inefficient for the detection of iodine in pure iodide of potassium, yet it answers very well with the iodide usually met with in commerce, the characteristic reaction being caused by the presence of even a minute portion of iodate of potash, which would not interfere with the medical action of the salt.—*Pharm. Journ.*

ART. XX.—ON THE ACTION OF ACIDS UPON AMYGDALINE.

By Professor Wöhler.

The composition of amygdaline is expressed by the formula $C^{40}\,H^{27}\,NO^{22}$. There is very little doubt that it is one of the so-called conjugate compounds. From the circumstance that it is separated by the influence of emulsine into sugar, prussic acid and oil of bitter almonds, it might be suspected that it really contains these substances as proximate constituents, for—

1 equiv. oil of bitter almonds	$C^{14}\,H^{6}\,O^{2}$
1 equiv. prussic acid	$C^{2}\,H\,N$
2 equivs. sugar	$C^{24}\,H^{20}\,O^{20}$
give 1 equiv. amygdaline	$C^{40}\,H^{27}\,N\,O^{22}$

But it might also be regarded as a combination of the protocyanide of benzoyle, $C^{14}\,H^{5} + C^{2}\,N$, with 2 atoms of gum :—

1 equiv. benzoyle	$C^{14}\,H^{5}$
1 equiv. cyanogen	$C^{2}\quad N$
2 equivs. gum	$C^{24}\,H^{22}\quad O^{22}$
	$C^{40}\,H^{27}\,N\,O^{22}$

On its metamorphosis, the elements of 2 atoms of water would separate from the gum and pass to the protocyanide of benzoyle, when the gum would appear as sugar, and the cyanide of benzoyle, in the form of prussic acid and oil of bitter almonds.

The action of acids upon amygdaline agrees perfectly well with both views; it is converted by them into formobenzoilic acid and a humus-like substance, while the whole of the nitrogen is separated in the form of an ammonium salt; the same decomposition consequently takes place as prussic acid and sugar of gum experience by acids. Sugar or gum yields the humus-like substance, and the formic acid produced from the prussic acid combines with oil of bitter almonds to form formobenzoilic acid. I have examined this reaction, it is true, only with muriatic acid; but undoubtedly all the stronger acids would act in a similar manner.

A solution of amygdaline in fuming muriatic acid soon acquires on heating a yellow, and then a brown colour, and on the further application of heat, a large quantity of a blackish-brown, pulverulent, humus-like substance separates. On filtering the humine, and evaporating the brown liquid in the water-bath, a blackish-brown syrupy mass remains, which is a mixture of humic acid, chloride of ammonium and formobenzoilic acid. The latter can be extracted with ether, and obtained in large tabular rhombohedrons. Its solution immediately disengaged carbonic acid and oil of bitter almonds when heated with manganese; moreover, the analysis of the acid and of its crystalline silver salt proved it to be formobenzoilic acid. On evaporating the acid liquid at a higher temperature than 212°, a portion of the formobenzoilic acid experiences an alteration, which deserves further examination. It becomes amorphous, forms a solution with a small quantity of water, but is precipitated, on the addition of more water, as a heavy yellowish oil without odour. The same change was observed with formobenzoilic acid prepared from bitter almond

water. A quantity of crystallized chloride of ammonium was obtained from the mass which had been exhausted with ether.

In the hope of producing directly from amygdaline the ether of formobenzoilic acid, which is still unknown, muriatic acid gas was passed into a mixture of alcohol and amygdaline. In proportion as the mass became saturated with it and heated, the amygdaline gradually dissolved to a clear solution, and nothing separated on cooling. The gum products were not formed in this case, and the liquid acquired but a very faint brownish tint. After some days a powder separated, which proved to be chloride of ammonium, more of which separated on the addition of ether. On the addition of a large quantity of ether, an aqueous acid liquid separated, which contained the chloride of ammonium, but no sugar. After it had been repeatedly shaken with ether, the ethereal solution was removed, and the ether distilled off. It left a brown syrup, which on mixture with water sank as a heavy liquid to the bottom. I have not examined this substance more minutely, but it may be considered with great probability to be the ether of amygdalic acid, produced by the sugar or gum in the amygdaline not being converted into humine, but entering into combination with the generated formobenzoilic acid; for the composition of amygdalic acid, $HO + C^{40} H^{26} O^{24}$, is such that it may be looked upon as a combination of—

1 equiv. oil of bitter almonds	$C^{14} H^{6} O^{2}$
1 equiv. formic acid	$C^{2} H O^{3}$
2 equivs. sugar	$C^{24} H^{20} O^{20}$

Amygdalic ether is undoubtedly colourless in the unaltered state. Obtained in the above manner, it is light brown, heavier than water, not miscible with it, but soluble in it to a considerable extent, especially on the application of heat, when however it is decomposed. It has a bitter, somewhat astringent taste, and is but slightly or not at all volatile.—*Chem. Gaz. from Liebig's Annalen.*

ART. XXI.—NOTICE RESPECTING AMIDULINE.

By Prof. F. Schulze.

I have applied the above name to a modification of starch which forms the transition between true starch and inuline or dextrine; it is an intermediate stage, which precedes all the metamorphoses of starch into dextrine, and is characterized by being readily and entirely soluble in hot water. It again separates from the concentrated aqueous solution after a longer or shorter time, owing to its insolubility in cold water; it reacts with iodine like starch.

This compound calls to mind Jacquelin's amylum granules, with which it is perhaps identical. It is distinguished from inuline by its reaction with iodine, and by not being converted into sugar on boiling its aqueous solution. It resembles dextrine in its solution, deviating the plane of polarization considerably to the right. It exhibits no reaction with lime and barytic water, nor with basic acetate of lead, and differs consequently in this respect from the so-called solution of starch.

With respect to the preparation of this substance, the same method is followed as for dextrine, only, with this difference, that the boiling of the mixture of sulphuric acid, water and starch is discontinued as soon as the starch is dissolved.

The acid is neutralized with carbonate of lime while the liquid is still hot. After the lapse of some time, frequently of several days, the amiduline separates in flakes easy of filtration, and which on drying assume all the appearance of white sago. Its elementary composition agrees exactly with that of starch.—*Chem. Gaz. from Journ. für Prakt. Chem.*

ART. XXI.—ON THE APPLICATION OF CHLORIDE OF AMMONIUM IN ANALYTICAL CHEMISTRY.

By Prof. H. Rose.

Prof. Rose recently drew attention to the very great use that might be made of the chloride of ammonium in quantitative analysis, from its converting several metallic oxides, when heated with them, into chlorides; the more volatile chlorides escape, and can thus be separated from the less volatile. Not merely oxides, but likewise several sulphurets are converted by chloride of ammonium into chlorides; for instance, the sulphurets of antimony, arsenic, tellurium and tin. The following additional observations respecting the behaviour of various bodies towards chloride of ammonium have been since published:—

Titanates.—When titanic acid is calcined with chloride of ammonium, the ammonical salt is driven off, and the titanic acid does not decrease in weight.

Titanic acid forms with the alkalies only acid insoluble salts; they dissolve in hydrochloric acid, except when deprived of their water by a red heat; they are then perfectly insoluble. It is consequently very difficult to ascertain their composition, especially when it is desired not to determine their amount of water by the loss. However, this is very easily accomplished by treating them with chloride of ammonium. The amount of water is first determined by ignition, the calcined compound mixed with sal-ammoniac, the mixture heated to redness, and this operation repeated until no further increase in weight results. While the titanic acid continues unaltered, the alkali exchanges its oxygen for chlorine, and the entire composition of the anhydrous salt can therefore be calculated merely from the increase in weight, for the difference between the atomic weight of the

oxygen and chlorine is to the atomic weight of chlorine as the increase in weight to the amount of chlorine in the mass treated with sal-ammoniac; but from this amount of chlorine that of the alkaline metal can be obtained, and also that of the titanic acid.

This determination can be checked in a very simple manner by treating the mass calcined with chloride of ammonium with water, which dissolves the alkaline chloride, the amount which can be determined by evaporation, while the titanic acid remains undissolved.

It resulted from the experiments made on this subject, that the potash salt dried at 212° has the formula $KO, 6T O^2 + 3HO$, and the soda salt $2NaO, 9TiO^2 + 5HO$. The first forms a powder, which appears perfectly crystalline under the microscope, and consists of vitreous fragments.

Sulphates.—The alkaline sulphates are completely decomposed on ignition with chloride of ammonium into alkaline chlorides, from the weight of which the amount of the sulphate can be accurately estimated. Sulphate of baryta is likewise decomposed by chloride of ammonium; but it is almost impossible to render the decomposition complete, because the chloride of barium formed melts, and so protects the undecomposed sulphate of baryta from further decomposition. Sulphate of magnesia is not decomposed by chloride of ammonium.

Seleniates.— Seleniate of baryta is converted, on calcination with chloride of ammonium, into a mixture of selenite of baryta and chloride of barium, which is coloured brown by free selenium.

Alumina Compounds.—Calcined alumina, rubbed to a fine powder, is for the greater part volatilized by treatment with sal-ammoniac. A small portion, however, of coarser nature, most tenaciously resists the action of the chloride of ammonium; and the alumina finally acquires, by the long ignition, such a state of density that it cannot be further decomposed by chloride of ammonium. Sulphate of alumi-

na, calcined with chloride of ammonium, is volatilized without leaving a residue.

Potash alum is completely decomposed; however, it does not leave pure chloride of potassium, but the sparingly volatile double compound of chloride of aluminum and chloride of potassium.

Glucina.—The compounds of this earth closely resemble those of alumina in their behaviour towards chloride of ammonium. The loose carbonate of glucina is more quickly decomposed by chloride of ammonium than the earth precipitated by ammonia; but even the former cannot be entirely volatilized by frequent treatment with chloride of ammonium. The more frequently the earth is heated to redness, the more it resists further decomposition.

Peroxide of Iron.—When mixed with chloride of ammonium and heated to redness, the mixture fuses, and readily flows over the crucible. A considerable quantity of iron is volatilized in red vapours as perchloride; and on the sides of the crucible peroxide of iron is deposited in a crystalline state, produced from the chloride by oxidation.

Manganese.—The oxides of this metal are converted, by treatment with chloride of ammonium, into protochloride, in which by oxidation some protoperoxide is formed.

Oxide of Nickel and Cobalt are converted into the metallic state when calcined with chloride of ammonium. The arseniuret of nickel (*Nickelspeise*) is, on the contrary, only partially decomposed, the arsenic being volatilized and the nickel left as chloride.

Oxide of Bismuth is reduced, with a lively deflagration, to metallic bismuth.

Silver Compounds.—Chloride of silver, mixed with chloride of ammonium and calcined, experiences no change; oxide of silver, heated to redness with chloride of ammonium, leaves both metallic silver and chloride. By the first action of the heat a portion of the oxide is reduced to metallic silver, which is not altered by ignition with sal-ammo-

niac; that portion of the oxide which has not been reduced by the heat before the chloride of ammonium begins to act is converted into chloride of silver. Antimoniuret of silver (the native coarse grained mineral from Wolach, Ag^3Sb) is but imperfectly decomposed by chloride of ammonium; by repeated treatment it is most probable that metallic silver would remain, since the more frequently it is calcined with chloride of ammonium, the more the antimoniuret of silver decreases in weight, and the residue becomes less brittle.

Lead Compounds.—Oxide of lead, calcined with chloride of ammonium, is converted into chloride of lead, which, on the access of air and the repeated addition of chloride of ammonium, may be entirely volatilized. Sulphuret of lead, calcined with sal-ammoniac, gives a fused blackish-brown residue, which is a compound of chloride and sulphuret of lead, and which, on the access of air, gives off dense vapours of chloride of lead, and may be wholly volatilized by the repeated addition of sal-ammoniac.

Oxide of Zinc is entirely volatilized as chloride of zinc when mixed with chloride of ammonium, but with great difficulty when the air is excluded.

Sulphate of zinc, deprived of its water of crystallization and calcined with chloride of ammonium, froths up very considerably. By repeated treatment with chloride of ammonium the residue can be wholly volatilized.

Oxide of Chromium and Crhomates.—The first experiences no change by calcination with chloride of ammonium, but the alkaline chromates leave a mixture of oxide of chromium and alkaline chloride; the latter dissolves on treatment with water, while the former is left undissolved. The alkaline chromates may be easily and accurately analysed by this method. The double sulphate of potash and oxide of chromium, after being deprived of its water, is converted into a mixture of oxide of chronium and chloride of potassium on ignition with sal-ammoniac.

Silicic Acid.—Silicic acid, which has not been heated too

strongly, decreases somewhat in weight on treatment with chloride of ammonium; but by long ignition it attains such a state of density as to withstand the action of sal-ammoniac. Crystallized silicate of soda in the anhydrous state is barely decomposed by ignition with chloride of ammonium.

Phosphates.—Phosphate of soda, calcined with chloride of ammonium, increases in weight; however, the weight of the residue diminishes by further treatment with sal-ammoniac, but still remains greater than that of the phosphate employed. A partial decomposition takes place; chloride of sodium is formed, and some phosphoric acid is expelled as hydrochloric acid by the phosphoric acid under the influeace of the air and moisture, whence the alternating increase and decrease in weight. Phosphate of lime is not decomposed by ignition with sal-ammoniac.

Compounds of Antimony.—The author has already shown that the antimony can be entirely expelled from the alkaline antimoniates by chloride of ammonium, and the alkali determined with accuracy as chloride. The combination of the alkaline sulphurets, especially the sulphosalt, consisting of sulphuret of sodium and sulphuret of antimony, commonly known by the name of Schlippe's salt, may be exceedingly well analysed by chloride of ammonium. In the case of this salt, pure chloride of sodium was left entirely free from every trace of antimony and sulphur.

Arseniates.—That alkaline arseniates are most readily converted by chloride of ammonium into alkaline chlorides has been already shown. The arseniate of lime, after calcination, leaves chloride of calcium, but the arseniate of magnesia is scarcely affected by treatment with sal-ammoniac. Sulphate of ammonia appears to decompose it entirely; however, this ammonical salt is not so well adapted for analytical purposes, as it fuses when heated and froths violently, rendering it difficult to prevent the mass flowing over the crucible.

Borates.—Borax is not affected by calcination with sal-

ammoniac; the latter escapes on the application of heat before the borax begins to fuse.

Fluorides.—Fluoride of sodium is decomposed by calcination with chloride of ammonium; it is however with great difficulty. The layer of fused chloride of sodium protects the still-undecomposed fluoride from further decomposition by chloride of ammonium. Fluoride of calcium is still less easily decomposed.

Bromides.—Bromide of sodium is decomposed, but not completely, by calcination with chloride of ammonium. When the treatment is frequently repeated, the residue consists principally of chloride of sodium, but always contains a considerable amount of bromide.

Iodides.—Iodide of potassium is decomposed by ignition with chloride of ammonium; but it is not entirely converted into chloride of potassium, even when the treatment is frequently repeated.

It is remarkable, that not only is chloride of ammonium incapable of decomposing the bromides and iodides completely, but also that it behaves exactly in the same manner towards fluorides, the partial decomposition of which by chloride of ammonium was not to be expected.

Nitrates.—Nitrate of potash is easily and entirely decomposed by chloride of ammonium, and yields accurately the the amount of chloride of potassium corresponding to the salt.—*Chem. Gaz. from Proc. of Berlin Academy.*

ART. XXIII.—ON SOME OF THE PROXIMATE PRINCIPLES OF VEGETABLES, THEIR NATURE, AND A NEW METHOD OF PREPARING THEM. By M. Lebourdais.

In 1825 I commenced a numerous series of experiments, with a view to obtain the proximate principles I imagined must exist in the Columbo root, the bulbs of *Scilla*, the the leaves of *Digitalis*, of *Ilex*, the flowers of *Arnica*, &c.

These experiments, although without satisfactory results, were nevertheless continued until 1840, when I gave up the use of chemical reagents, and resolved to try some substance which, possessing both a chemical and mechanical action, would have a kind of elective affinity, so as to seize hold of certain substances and eliminate others. After numerous experiments, I tried animal charcoal with perfect success. My first experiments with this reagent were made on a spirituous extract of Digitalis. The solution, which was not very highly coloured, having been previously precipitated with acetate of lead and filtered, was agitated with animal charcoal and the flask containing the mixture set aside; to my great astonishment, the liquid, on depositing the charcoal, had become not merely colourless, but had entirely lost its bitter taste. I decanted the liquid and washed the charcoal with distilled water, dried it in the stove, and then treated it with boiling alcohol, which acquired a pale tint, and took up the whole of the bitter principle. The alcohol, on evaporation in the water-bath, left at the bottom of the vessel an amber-coloured liquid, which deposited a pulverulent substance, the quantity of which increased after some time and cooling. This new substance, separated and washed, dissolved in alcohol, and furnished by its spontaneous evaporation crystals of digitaline. The crystals dissolve, but in small quantity, in water, to which they communicate a very bitter taste; they are more readily soluble in weak than in strong alcohol, and more so in hot than in cold. Ether has but little action upon digitaline. Both the alcoholic and the aqueous solution are neutral, as they have no action upon blue litmus-paper and upon that which has been reddened by an acid.

Sulphuric acid dissolves digitaline, and this solution finally acquires suddenly a very beautiful purple colour. After a time this colour disappears, passing into a brown, and a precipitate forms in the liquid of a blackish substance, produced by the decomposition of the proximate principle. If

the purple solution of digitaline in sulphuric acid is diluted with water, it instantly loses its colour, and acquires a yellowish-green one, resembling that of chlorine. Concentrated nitric acid dissolves it without assuming any colour; the same is the case with hydrochloric acid. No precipitate is formed by pouring ammonia into solutions of digitaline. The same was found to be the case with acetate of lead, lime-water, potash and soda. Digitaline did not appear to to me contain any nitrogen.

This process having furnished me with a very satisfactory result, I applied it, with certain modifications, to isolate other proximate principles, and always with success.

Ilicine.—2 lbs. of powdered holly-leaves, treated with boiling water, furnished a greenish decoction, which was very bitter; the liquid was decanted, filtered, and boiled with animal charcoal, being stirred constantly. On removing the flask from the fire, the charcoal subsided, and the liquid, which had lost its colour and much of its taste, was decanted. The animal charcoal was washed, boiled, and treated with boiling alcohol, to which it imparted the bitter taste of the holly; the liquid was filtered, and the alcohol removed by distillation, when a colourless inodorous liquid remained at the bottom of the vessel, of a very bitter taste and a syrupy consistence. This solution was neutral; it furnished, on spontaneous evaporation or in the stove, a solid amorphous substance, of the appearance of gelatine, to which I have given the name of Ilicine. It is soluble in water and in alcohol; and although not hygrometric, I have not been able to obtain it in the crystalline state.

Scillitine.—A concentrated, highly-coloured and vicious decoction of the bulbs of squills was precipitated by acetate of lead (the viscosity of the liquid preventing the precipitation of the animal charcoal), and filtered. The resulting liquid was agitated in the cold with animal charcoal, and the vessel containing the mixture set aside; gradually the animal charcoal subsided, and carried down with it the bitter and colouring principles; the liquid was decanted, and

the charcoal washed, dried and treated with hot alcohol, which became excessively bitter. After filtration the alcohol was removed by distillation, when a milky liquid remained in the retort, in which floated numerous minute particles of a whitish substance, sparingly soluble in water, to which it nevertheless imparted an intense bitter taste; it dissolved readily in alcohol, and the solution left an amorphous residue on spontaneous evaporation. The milky liquid evaporated in the hot chamber gave the same result. This substance is neutral, does not absorb moisture from the atmosphere, and produces on the tongue a sensation analogous to that caused by a caustic substance. Scillitine, as thus obtained, is solid, is readily decomposed by heat, dissolves in concentrated sulphuric acid, and appears to communicate to the solution a purple colour, which instantly disappears, and turns black, owing to decomposition. It is also dissolved by nitric acid, but decomposed at the same time.

Arnicine.—A concentrated infusion of the flowers of *Arnica montana* was gradually filtered through a thick layer of animal charcoal, which had been previously washed. The filtered liquid was deprived of the bitter and colouring principles. The charcoal, after being washed and dried, was treated with alcohol, to which it imparted the bitter taste of the arnica. The alcoholic solution was filtered, and submitted to distillation; it left a milky liquid, which furnished on evaporation a substance having the appearance and consistence of turpentine. It is but very sparingly soluble in water, but nevertheless imparts to it a bitter taste. It dissolves in every proportion in alcohol; the solution, on spontaneous evaporation, leaves a residue of a syrupy consistence. Arnicine is neutral. Acetate of lead must not be used in the preparation of this substance, as the precipitate carries down with it nearly the whole of the arnicine.

Columbine.—An aqueous infusion of the Columbo root, obtained by displacement, was filtered through a thick stratum of animal charcoal; in its passage it was deprived of its

bitter taste and colour. The charcoal, after being washed and dried, was treated with alcohol, to which it communicated the colour and taste of the Columbo. This solution deposited minute crystals of columbine on spontaneous evaporation. If, instead of treating the charcoal with alcohol, a stream of water is passed through it as long as the liquid which filters has a bitter taste, the columbine is removed, but not the colouring substance, which may now be obtained separately by digesting the charcoal with alcohol. The columbine may thus be obtained perfectly pure and crystalline.

Colocynthine.—A concentrated infusion of the parenchyma of the fruits of the colocynth was first precipitated with acetate of lead, filtered, and treated in the same manner as for the preparation of columbine. The solution obtained on spontaneous evaporation deposited the colocynthine in mammillated tufts.

Strychnine.—An infusion of nux vomica, treated in the same manner as the Columbo, furnished strychnine, with all the physical and chemical characters of that obtained by the processes hitherto employed—a proof of the pre-existence of alkaloids in vegetables.

Of the substances upon which I experimented only the three last were found to possess the property of combining with animal charcoal, and then leaving it when treated with water, and on treating this solution with charcoal again uniting with it.

The juices of hyoscyamus, hemlock, &c., treated in the same manner as the flowers arnica, yielded the principles of these plants, some in an amorphous, others in the crystalline state. Wishing to confirm as much as possible the undoubted existence of certain proximate principles in vegetables in the alkaloid state, I prepared morphine, narcotine and quinine by the same method. The experiments to obtain the latter appear to me to be conclusive.

500 grms. of *Cinchona calisaya* were exhausted with water, acidulated with sulphuric acid, and the acid decoc-

tion filtered through washed animal charcoal. The liquid after having traversed the layer of animal charcoal, was insipid and colourless. The charcoal was washed and dried, and treated with alcohol of 0 848 spec. grav.; the alcoholic solution furnished, on evaporation in the water-bath, a milky liquid, and the sides of the vessel were covered with crystals of quinine. The milky liquid turned red litmus-paper blue, and on treatment with sulphuric acid furnished sulphate of quinine.

To avoid the objection that might be made with regard to the action of the sulphuric acid on the lime-salts contained in the animal charcoal, I proceeded as follows:—500 grms. of the same bark were deprived of their soluble principles by repeated macerations in alcohol of 0.923, the resulting liquids filtered, the alcohol removed by distillation, the liquid residue mixed with two decoctions of the same bark in distilled water, the mixture filtered through paper, and then through animal charcoal which had been previously deprived of the salts of lime, &c., by hydrochloric acid, and well washed. The liquid passed slowly through the charcoal, and was deprived of its bitter taste and colour. This charcoal was now washed, dried, and treated with alcohol of 0.848. The alcoholic solution left on distillation a mixture of quinine and resinous substance. To obviate this inconvenience, I repeated the preceding operation, adding to the mixture of the alcoholic macerations and aqueous decoctions a certain amount of acetate of lead, which precipitated the resinous substance. The liquid, filtered from this precipitate and treated as above, furnished the quinine in a state of perfect purity.

These experiments, besides proving the pre-existence of certain alkaloids in plants, open a new path of organic analysis, and complete in some measure the study of the principal properties of animal charcoal.—*Ibid, from Ann. de Chim. et de Phys.,*

Editorial Department.

THE CHOLERA.—The foreign journals teem with statements relative to the progress of this fearful epidemic, exposing its ravages from city to city, as it involves one nation after another in its dreaded influence, without being retarded, apparently, in the slightest degree by the strictest quarantine, and only modified in its deadly effects on the communities, by the general sanitary measures that may, collectively and individually, have been adopted. Whilst Moscow and Constantinople were being scourged, the press of England was alive to arouse the municipal government to the adoption of means of protection or amelioration, and the government seems to have seized on the idea, as, by the appointment of a general "Board of Health," consisting of Lord Morpeth, Lord Ashley, and Mr. Chadwick, they have opened the door to a more extended and thorough sanitary reform. Eminent physicians have been consulted, and a pamphlet of directions and advice, relative to the precautions to be observed in the removal of all causes of miasm, and in the treatment of cholera in its incipient stages, when timely interference by even the unprofessional is of great value. It is made the duty of the Guardians of the Poor and parochial authorities to visit the premises in their districts, to see that the measures of the Board are carried out.

They say: "The chief predisposing causes of every epidemic, and especially of cholera, are damp, moisture, filth, animal and vegetable matters in a state of decomposition; and, in general, whatever produces atmospheric impurity." "Next to the perfect cleansing of the premises, dryness ought to be carefully promoted, which will of course require the keeping up of sufficient fires, particularly in the damp and unhealthy districts, where this means should be resorted to for the sake of ventilation as well as of warmth and dryness."

After enlarging on these precautionary sanitary measures, they direct attention to the importance of combating the first premonitory symptoms of the disease without delay, which are thus described: "This premonitory symptom is looseness of the bowels, which there is reason to regard as universally preceding the setting in of the more dangerous stage of the disease. Sometimes, indeed, under the circumstances

already described—namely, where the poison exists in unusual intensity—or the constitutional predisposition is unusually great, the first stage may appear to be suppressed, as occasionally happens in violent attacks of other diseases; but in cholera, this event is so rare, as to be practically of no account; and in all countries, and under all varieties of conditions in which this disease has been epidemic, the experience as to this point uniformly agrees with what is observed at the present moment at Hamburg."

"This looseness of the bowels may be accompanied with some degree of pain, which, however, is generally slight; but in many cases pain is wholly absent; and for some hours, or even days, this bowel complaint may be so slight as to appear trifling; so that, without a previous knowledge of the importance of the warning, it might easily escape notice altogether."

"It must be repeated, however, that when Asiatic cholera is epidemic, the slightest degree of looseness of the bowels ought to be regarded and treated as the commencement of the disease; which, at this stage, is capable of being arrested by simple means, but if neglected only for a few hours, may suddenly assume a fatal form."

They recommend that "each member of the visiting committee in the districts or wards be provided with proper remedies, prepared in appropriate doses for administration on the spot, in every instance in which the premonitory symptom is found to exist."

They state that authorities agree that the looseness of the bowels premonitory to cholera, should be treated in a similar manner with ordinary diarrhœa—opiates, absorbents and aromatics are resorted to, as a table spoonful of chalk mixture with eight or ten drops of laudanum; ten grains of the compound powder of chalk with opium, which is equivalent to it, or twenty grains of confection of opium, which contains about half a grain of that drug, for a dose every two or three hours, and if severe, tincture of catechu may be added in half drachm doses. The camphor mixture, consisting of camphor water, lavender compound, and sugar, with a few drops of laudanum in each dose, will be equally efficacious.

"It is recommended to repeat these remedies night and morning for some days after the looseness of the bowels has been stopped, but in all cases, whenever practicable, that even in this earliest stage of the disorder recourse should be had to medical advice."

These views are fully corroborated and seconded by the advices from Constantinople, of a physician who has had large experience in the treatment of cholera, and witnessed the disease in all its degrees of progress. He states that there is hardly an instance, that came under his observation, of an attack of cholera, *not* preceded by a diarrhœa of

some type,—sometimes so slight as to escape the observation of the patient. Nor had he known of a case where this premonitory symptom had been attended to, that had progressed to the malignant stage of the disease.

The circular of the British Board of Health before alluded to, lays great stress on the importance of a constant watchfulness over the diet and clothing during the prevalence of a cholera atmosphere. "Whenever Asiatic cholera is epidemic, there is invariably found among great numbers of the inhabitants an extraordinary tendency to irritation of the bowels; and this fact suggests that every article of food which is known to favor a relaxed state of the bowels, should, as far as possible be avoided,—such as every variety of green vegetables, as cabbage, cucumbers, salad &c." A safe plan is for each to revert to his own experience, and refrain from whatever has caused gastric and intestinal irritation, and as a general rule avoid articles having much indigestible vegetable fibre, as beans, celery, &c. Fresh meats are better than salted, and in fact the ready digestibility of the diet, is the best criterion to follow in selecting it. Sudden and wide departures from either the quantity or quality of the usual diet are however to be deprecated, as such changes are more likely to bring on a derangement of the alimentary canal, than a gradual accommodation of the diet to the prescribed regimen. This attention should be constant—a single act of indiscretion may place the subject beyond the reach of physic. We well recollect an instance of this during the last cholera season in this city, a carrier, or barrow-man attached to one of the hospitals, whose duty it was to bring the patients to the establishment on the portable bed, then used for the purpose. This individual also had partial charge of the green house where the dead were placed previous to their burial. Having obtained leave of absence from Saturday until Monday, he took advantage of Sunday to have an old-fashioned dinner of bacon and cabbage. The next day found him a patient, and soon after he was an occupant of the dreary apartment he had superintended—a sacrifice to his temerity. Whilst this attention to the quality of the diet is so strongly recommended, there should not be any attempt at fasting. "The intervals between the meals should be regular, and not too long; cholera being uniformly found to prevail with extraordinary intensity, among the classes that observe the protracted fasts common in Eastern and some European countries."

"On account of the intimate connection between the external skin and internal lining membrane of the bowels, warm clothing is of great importance. The wearing of flannel next to the skin is therefore advisable," and any course preventive of sudden checks to perspiration should be observed. During the prevalence of cholera—especially in

warm weather one of the causes predisposing to disease is fatigue. Over exertion of any kind should be avoided—especially if there is any tendency to diarrhœa—whether it be mental or physical—calmness of mind, based on a sense of having attended to all the precautionary measures is altogether favorable to preventing an attack.

The use of cold cathartic medicines of a saline character, as epsom and glauber salts should be avoided, and drastic purgatives—the use of which in this country in the form of the legion of quack pills, which are taken almost as regularly as food, by many—should be especially shunned.

"If, notwithstanding these precautionary measures, a person is seized suddenly with cold, giddiness, nausea, vomiting, and cramps, under circumstances in which instant medical assistance cannot be procured, the concurrent testimony of the most experienced medical authority shows that the proper course is, to get as soon as possible into a warm bed; to apply warmth by means of heated flannels, or bottles of hot water, or bags of heated chamomile flowers, sand, bran or salt; to the feet, and along the spine; to have the extremities diligently rubbed; to apply a large poultice of mustard and vinegar over the region of the stomach, keeping it on 15 or 20 minutes; and to take every half hour a teaspoonful of sal volatile (aromatic, spt. hartshorn) a dessert spoonful of brandy in a little hot water, or a wine glass full of wine whey, made by pouring a wine glassful of sherry into a tumbler of hot milk—in a word, to do every thing practicable to procure a warm general perspiration, until the arrival of the medical attendant,—whose immediate care under such circumstances is indispensable."

In conclusion, we would observe that more may be accomplished by exciting individual attention to the general facts, and inducing each to guard his own conduct, and advise his neighbors when able, than by any other course, and whilst our Boards of Health and special sanitary officers may be using their endeavours to correct those conditions favourable to the virulence of the disease, each member of the community should conscientiously assume his part by a careful attention to these recommendations, which are founded on a fearful amount of past experience.

New Work on Practical Pharmacy.—We take pleasure in announcing that the new work of Mohr & Redwood is in press, and will be published by Messrs. Lea & Blanchard as soon as the execution of the numerous illustrations will admit. We have no hesitation in saying that it will be an extremely valuable addition to the pharmaceutical literature of this country.